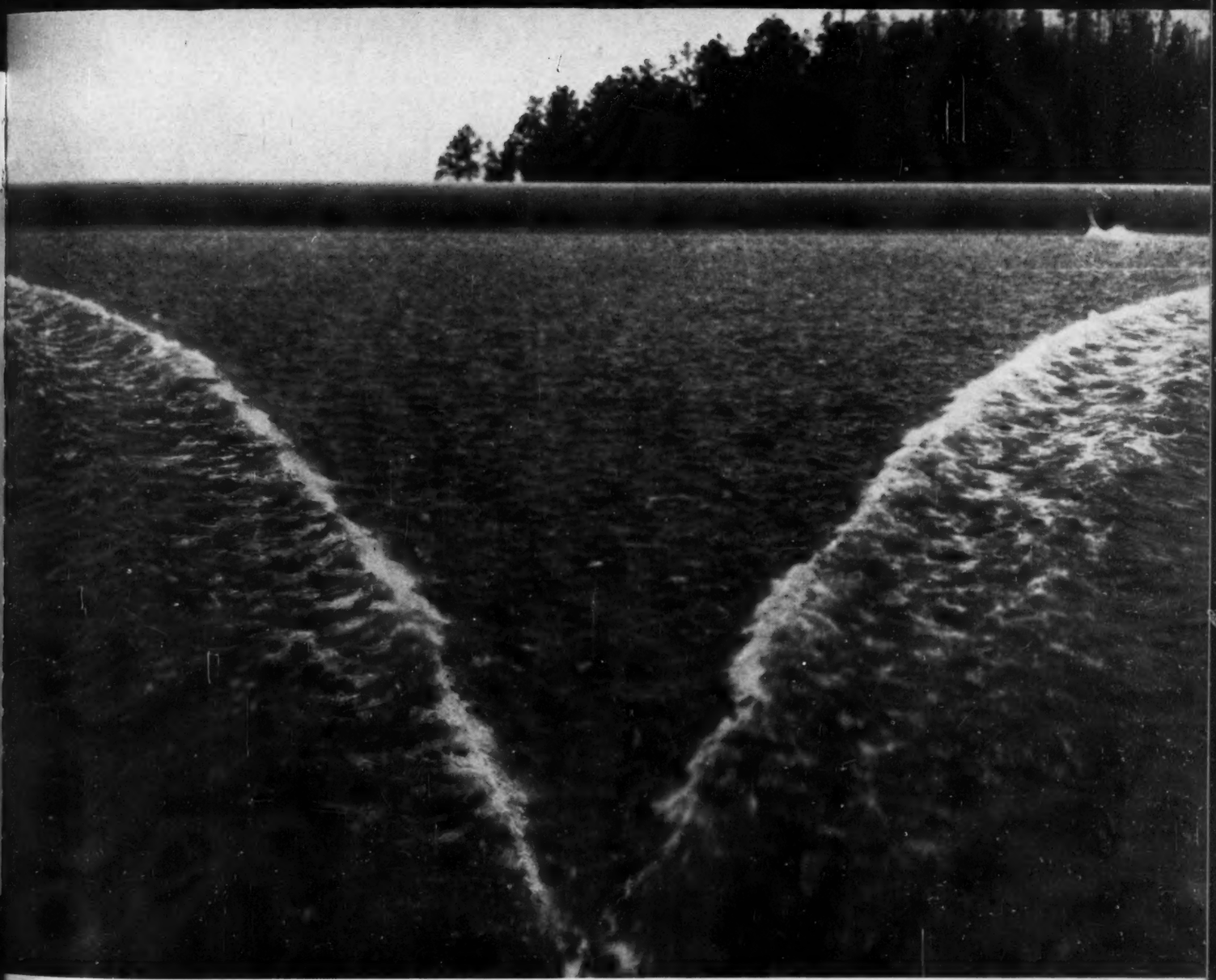
WATER WORKS & SEWERAGE

ABP ABC

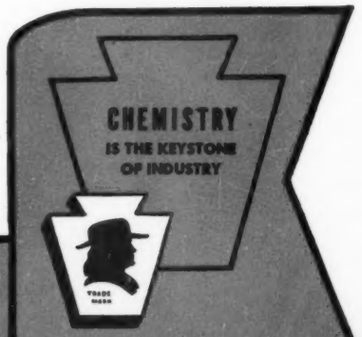


LITTLE ROCK'S "V" FOR VICTORY

EACH TIME LAKE WINONA OVERFLOWS IT HANGS UP THIS IMPRESSIVE "V"-FOR VICTORY ON ITS SLOPING SPILLWAY FOR LITTLE ROCK CITIZENS TO VIEW

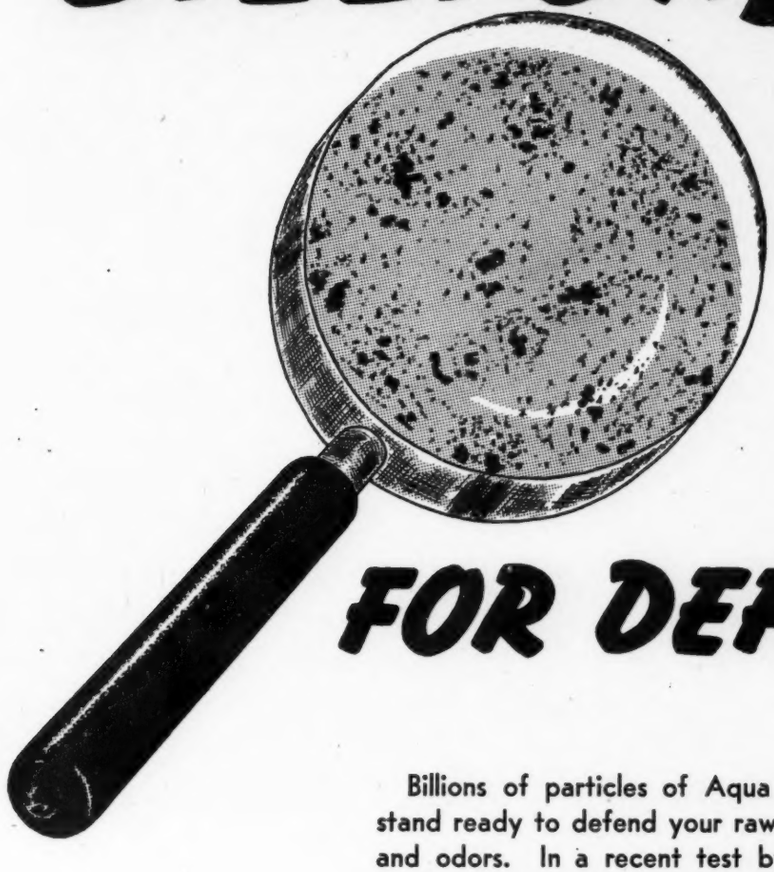
Liquid chlorine is an *essential* war material. Tremendous quantities are called for—to fill many urgent, *vital* war demands. To meet our obligations in emergency war orders and public health needs, we have expanded our production. But the supply for many normal uses is still strictly limited.

By efficient handling of chlorine for civilian needs, you can aid directly in the great national war effort. You can cooperate further by returning empty chlorine cylinders promptly.



PENNSYLVANIA SALT
MANUFACTURING COMPANY
1850 *Chemicals* 1942
1000 WIDENER BUILDING, PHILADELPHIA
BRANCH OFFICES: NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • WYANDOTTE • TACOMA
PLANTS: PHILADELPHIA • EASTON • NATRONA • WYANDOTTE • TACOMA • PORTLAND, ORE.

BILLIONS



FOR DEFENSE

Billions of particles of Aqua Nuchar Activated Carbon stand ready to defend your raw water supply against tastes and odors. In a recent test by Roy M. Allen, prominent microscopist of Bloomfield, N. J., a regular commercial grade of Aqua Nuchar Activated Carbon was found to contain 120 billion particles per gram.

This microscopic fineness only partially explains Aqua Nuchar's amazing ability to remove by adsorption, tastes and odors from water supplies. For besides having 120 billion particles per gram, one cubic inch has a surface area (external and internal) of 20,000 square yards. This extraordinary porosity of Aqua Nuchar not only results in greater adsorption, because of the larger surface area exposed, but also accounts for its superior properties of dispersion and suspendability.

INDUSTRIAL CHEMICAL SALES

NUCHAR

WATER WORKS & SEWERAGE, November, 1942. Volume 89. Number 11. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

25 YEARS OF PROVIDING THE EAGLE WITH CLAWS!

. . . . . AND TWENTY-FIVE YEARS OF ACCUMULATED "KNOW HOW" IN THE MANUFACTURE OF MUNITIONS FOR UNCLE SAM AND . . . . . OF PROVIDING OUR GOOD CUSTOMERS WITH QUALITY BRASS AND COPPER PRODUCTS.

TWENTY-FIVE YEARS AGO THIS FACTORY WAS WORKING ENTIRELY FOR UNCLE SAM—in fact, our country's need in the first World War was the very reason for our birth and existence. TODAY WE ARE AGAIN WORKING 100% TO SUPPLY WAR MATERIALS FOR OUR ARMED FORCES—AND DURING ALL THE YEARS BETWEEN THE FIRST AND SECOND WORLD WAR IN WHICH WE WERE BUILDING A LARGE DOMESTIC BUSINESS, WE ALSO CONTINUED TO SUPPLY ORDNANCE MATERIAL FOR UNCLE SAM'S NAVY.

STREAMLINE Copper Pipe and Fittings are now in the service of our country for many purposes. They are installed in naval vessels of practically all types including victory ships, sub chasers, submarines, mine sweepers, etc. They are used for plumbing, heating, refrigeration, air conditioning, oil lines and a multitude of other services afloat and ashore.

On this our TWENTY-FIFTH ANNIVERSARY, we dedicate ourselves to an all-out effort for war . . . knowing that only through the winning of it can we gain a lasting peace. When peace returns to the world, we can regain those businesses of which we are now temporarily deprived, and STREAMLINE Copper Pipe and Fittings will once more protect the health of the nation as they are now protecting the health and lives of our men in the service.

We Proudly Fly the Army-Navy "E" for Excellence and Timely Production of Ordnance Material.

STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN

Accurate, Dependable MEASUREMENT

For the duration and for years to come . . .

THE continued manufacture of water meters, made to conform to the limitation order on the use of bronze, has the full approval of the War Production Board. Meters avoid waste of the water that they measure. They also conserve many times the small amount of critical materials used in their construction by reducing the need for additional pipelines, pumping equipment, purification and reservoir facilities. Under the circumstances, no water works man should feel that he is hindering the war effort by buying today the new meters that are actually needed in his operations.

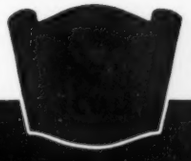
The Pittsburgh-National organization pioneered in meter designs approved by the War Production Board. We are in full production on both Pittsburgh Ironside and Empire Victory Meters. The Ironside is of the disc type with the same inner working mechanism that has been proven in thousands of Arctic and Tropic Meters. The Empire Victory Meter employs the time tested oscillating piston principle of measurement, developed by National and popularized for over 50 years. Both meters are thoroughly accurate measuring instruments, designed to give many years of dependable service. Together they provide the necessary types to handle practically every domestic water meter requirement or preference of operating men.

THE NEW MOLDED GLASS REGISTER BOX

A single piece, strong, molded glass unit which fits snugly over the register and is retained against a fibre gasket. Serves as both register box and lid; protects register against dust and moisture; will withstand considerable abuse.

PITTSBURGH-NATIONAL METERS

THE MOST COMPLETE LINE OF WATER METERS IN THE WORLD



PITTSBURGH EQUITABLE METER COMPANY

NEW YORK · BROOKLYN · DES MOINES · MEMPHIS · OAKLAND · TULSA · CHICAGO · BOSTON

MERCO NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa.
NATIONAL METER DIVISION, Brooklyn, N. Y.

KANSAS CITY · PHILADELPHIA · SAN FRANCISCO · LOS ANGELES · SEATTLE · HOUSTON · COLUMBIA · BUFFALO

MACMILLAN PIONEERS AGAIN!

New 1-Quart Container Without Metal for RING-FREE MOTOR OIL!

NON-REFILLABLE

HERE IT IS! The quart container for motor oil which motorists and dealers have been expecting!

And it's Macmillan who pioneers again! A "can" without metal for RING-FREE!

With the steel mills converted to war purposes, the supply of metal cans for oil has dwindled and virtually disappeared. That was natural and right.

But motorists, wanting to be sure of getting RING-FREE—in its own quickly identified quart containers—have been hoping that this difficult packaging problem would be solved.

Now the new quart is ready! Now every *independent* dealer selling RING-FREE can open this new container and put in the fill of RING-FREE every car has been thirsting to get!

Among other things, Macmillan pioneered with RING-FREE motor oil ten years ago. There never has been an oil like it. There can't be, because it's refined by an exclusive, patented process.

That's why it removes carbon, saves as high as 10 per cent on gas, reduces friction fast, saves wear and repairs and lengthens the life of your car.

Now Macmillan pioneers again—after months of search and research—bringing out a metal-less container to assure motorists of getting RING-FREE!

The Macmillan sign is shown at *independent* filling stations, garages, and car dealers. Drive in and get your fill of RING-FREE today!

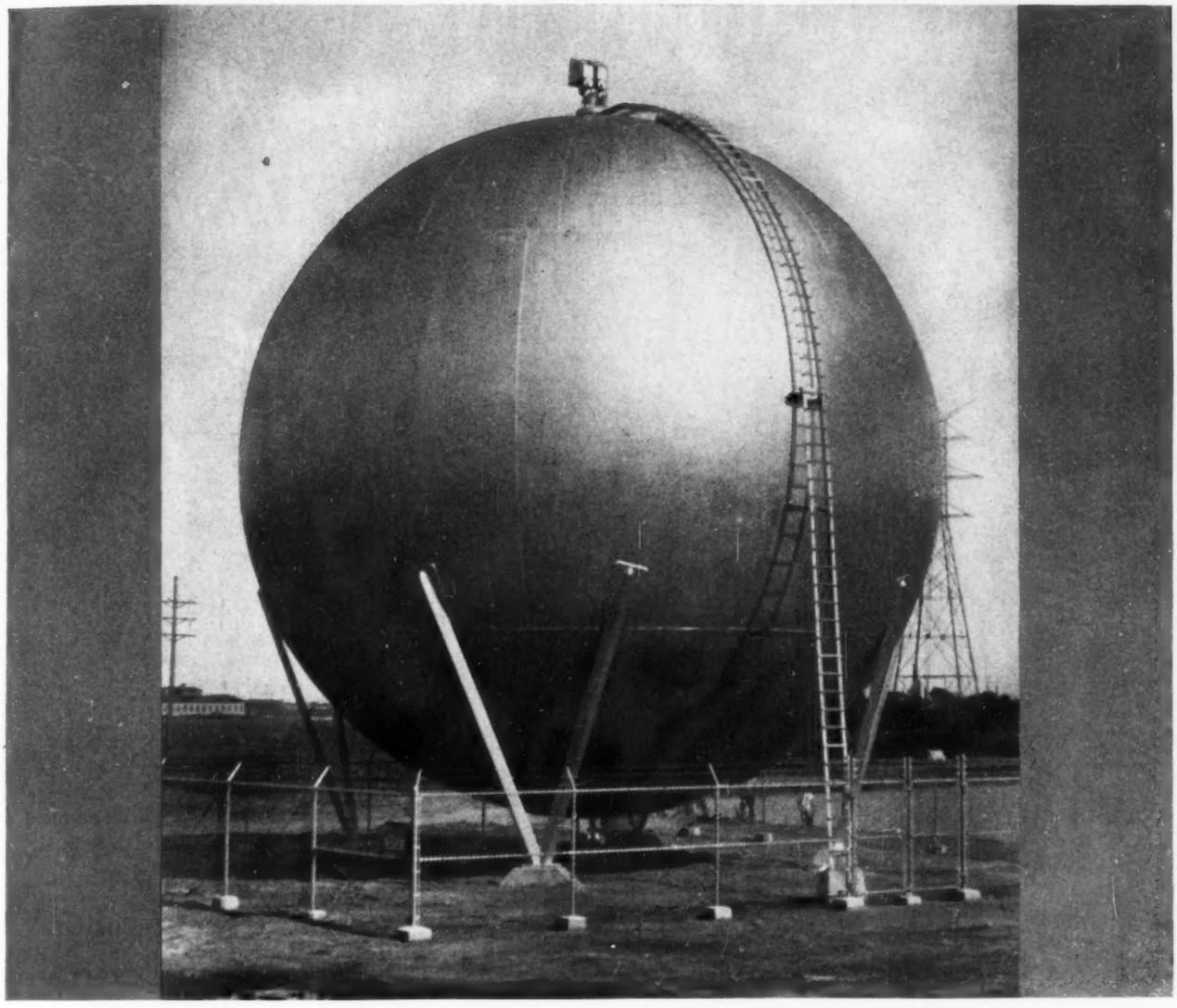
MACMILLAN
RING-FREE
MOTOR OIL

35c
A QUART IN U. S. A.

MACMILLAN PETROLEUM CORPORATION
50 West 50th Street, New York
624 South Michigan Avenue, Chicago • 530 W. 6th Street, Los Angeles

Copyright 1942 by
Macmillan Petroleum Corp.

HORTONSPHERES



PROVIDE ADEQUATE GAS STORAGE *at Sewage Disposal Plants*

AT SEWAGE disposal plants utilizing the digestion process of sludge elimination, HORTONSPHERES can help provide an adequate supply of gas for normal heat and power needs.

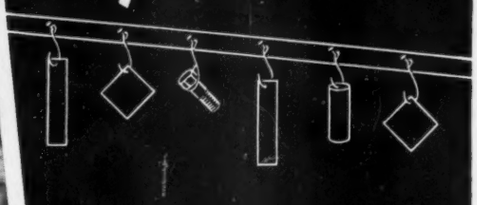
The 45 ft. 6 in. diam. HORTONSPHERE illustrated is installed at the Hammond, Ind., sewage disposal plant. Through the use of this spherical, high-pressure gas holder, the efficiency of the plant is increased. When an abundant supply of gas is being produced in the digesters, compressors pump excess not needed for immediate use into the HORTONSPHERE. When the output of the digesters falls below current needs and pressure in the gas lines falls below the set minimum, the sphere automatically delivers gas back into the system, thereby maintaining an adequate reserve of gas at all times.

CHICAGO BRIDGE & IRON COMPANY

Chicago.....2193 McCormick Bldg.	Birmingham..1586 North 50th Street	Philadelphia...1644-1700 Walnut St.
New York.3390-165 Broadway Bldg.	Tulsa.....1646 Hunt Bldg	Washington.....330 Bowen Bldg.
Cleveland.....2262 Guildhall Bldg.	Houston.....5615 Clinton Drive	San Francisco.....1083 Rialto Bldg.
Havana.....402 Edificio Abreu	Detroit.....1551 Lafayette Bldg.	Greenville.....York Street

Plants at BIRMINGHAM, CHICAGO, and GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.

NO NEW INSTALLATIONS NOW...BUT *the proving of Aluminum goes on!*



Ten years ago, test samples hung in the "tough spots" in a few sewage plants were Aluminum's only service proving grounds.

Hose them down occasionally; Aluminum Alloy gratings need no more attention than that.

An enviable performance record is being built up by the aluminum that's installed in water treatment and sewage disposal plants around the country. Aluminum Alloy windows and doors, skylights and coping, ventilating ducts and conduit, grating, stop gates, weirs and diffuser plate holders; all are proving what they can do under the trying conditions they have to face.

This history will serve as a guide for the day when Aluminum Alloy products again become available for these uses. Alcoa engineers, turning to these service records, will be able to say, "Yes, aluminum will work out fine there," or, "Another material does that job better." They'll have more facts than ever.

Where aluminum is on the job, maintenance is made easier. Decorative aluminum is easy to keep bright and shining. Clearing away the dirt and cinders that collect in corners reduces the possibility of corrosion. Contacts with other metals should be avoided, to prevent electrolysis. Your aluminum equipment will repay you many times over for such attention to details.

Alcoa engineers can help you decide what steps to take to assure longer life for the aluminum that's at work in your plant. For this assistance, write ALUMINUM COMPANY OF AMERICA, 1955 Gulf Bldg., Pittsburgh, Penna.

ALCOA ALUMINUM

Too Important FOR A HALF-WAY JOB

CONVENIENT INGOT FORM
IMPERVIOUS TO MOISTURE
CANNOT CHANGE COMPOSITION
EASY TO HANDLE, STORE AND SHIP
SUPER RESISTANT TO THERMAL AND MECHANICAL SHOCK

Doing any job right the first time may save the need of doing it over. Growing scarcity of materials and labor serves to stress the sound economy of *better* bell and spigot main jointing. *Tegul*-MINERALEAD is a better jointing compound, with definite advantages not matched in total in any other.

Tegul-MINERALEAD

Tegul-MINERALEAD MAKES PERMANENTLY TIGHT JOINTS — needs no skilled labor, caulking or deep bell holes. Works with pipe of any diameter up to 48".

MINIMUM INITIAL LEAKAGE — The inclusion of Thiokol (synthetic rubber) in T-M's sulphur base not only cuts initial leakage to a minimum, but speeds complete sealing. Backfilling can proceed at once. Traffic hazards may be cleared up and premises restored to normal.

T-M TEN POUND INGOTS are particularly convenient to handle, store and ship. Impervious to water, they may be stored in the open unprotected, in any weather.

COMPOSITION CAN'T CHANGE — You can't shake down the components of a solid ingot. T-M reaches the job with composition unchanged. Think of the trouble *that* may save.

HIGH RESISTANCE TO MECHANICAL AND THERMAL SHOCK — The sturdiness of T-M joints is good insurance against service interruptions and helps keep maintenance costs down. In lines carrying hot water, T-M's resistance to thermal shock makes it the only practical compound.

WEIGHS ONLY 1/5th AS MUCH AS LEAD; goes three times as far. *Tegul*-MINERALEAD saves at every step: in shipping, storing, laying and in upkeep and repairs.

THERE'LL NEVER BE A BETTER TIME THAN RIGHT NOW TO SEND FOR COMPLETE INFORMATION THAT WILL BRING YOU SOUND ECONOMIES IN YOUR LAYING OF BELL AND SPIGOT PIPE • WRITE TODAY TO

The ATLAS MINERAL Products Co.

OF The House Jointing Materials PENNA.

Hertztown Pennsylvania

*ATLANTA, Ga. 175 Spring St., S. W.
*CHICAGO, Ill. 333 N. Michigan Ave.
*DALLAS, Tex. 3921 Purdue Street
*DETROIT, Mich. 2970 W. Grand Blvd.
*KANSAS CITY, Kan. 1913 Tauromee Ave.
NEW YORK CITY, 280 Madison Ave.
PITTSBURGH, Pa. (10)4656 Old Boston Road
TORONTO, Ont., McRae Engineering Equipment, Ltd. 11 King St., West

The ATLAS MINERAL Products Company of California
REDWOOD CITY, California

*DENVER, Colorado, 1921 Blake Street
*HONOLULU, Hawaii, U.S.A.
*LOS ANGELES, Cal., 817 Yale Street
*SEATTLE, Wash., H. D. Fowler Company 558 First Avenue, South

*Stocks carried at these points

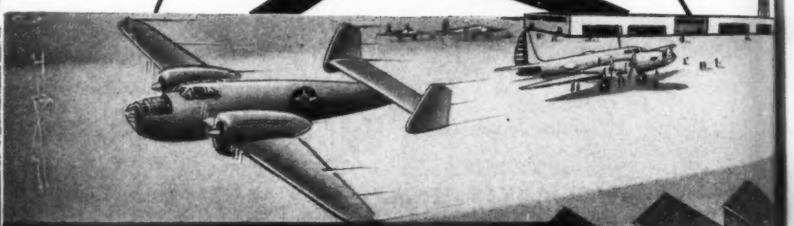
for the DURATION—

Elevated Steel Tanks

By

PITTSBURGH •DES MOINES

ARE SERVING BY THE HUNDRED THE BASES, AIRFIELDS, CAMPS, WAR INDUSTRIES OF AN AMERICA IN ARMS.



for the future—

WE INVITE YOU TO BUILD PITTSBURGH • DES MOINES' DESIGN, ERECTION AND PERFORMANCE INTO YOUR POST-WAR PLANNING FOR A BETTER COMMUNITY!

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, P.A. 3418 NEVILLE ISLAND • DES MOINES, IOWA, 919 TUTTLE STREET
NEW YORK, ROOM 918, 270 BROADWAY • CHICAGO, 1222 FIRST NATIONAL BANK BUILDING
DALLAS, 1223 PRAETORIAN BUILDING • SAN FRANCISCO, 625 RIALTO BUILDING
SEATTLE, 1126 EIGHTH AVENUE, SOUTH

EXPERIENCE ...picks Sodium Silicate WATER TREATMENT

FOR

★ BETTER QUALITY OF WATER
★ HIGHER FILTRATION RATE
★ LOWER COSTS

ALKALI

Use.... STANDARD SILICATE

for
- UNIFORMITY
- DEPENDABILITY
- IMPROVED FLOCCULATION

Write for information on the best way to use the Silicate Treatment in your plant. Use the coupon.

Standard Silicate Division, Diamond Alkali Company,
Oliver Building, Pittsburgh, Pa.

Our water supply has the following characteristics:

..... Million Gallons per Day Average Turbidity .....

Present Dosage ... gr./gal. Coagulant .....

We would be glad to receive further information on the use of Standard Silicate.

Name ..... *Title* .....

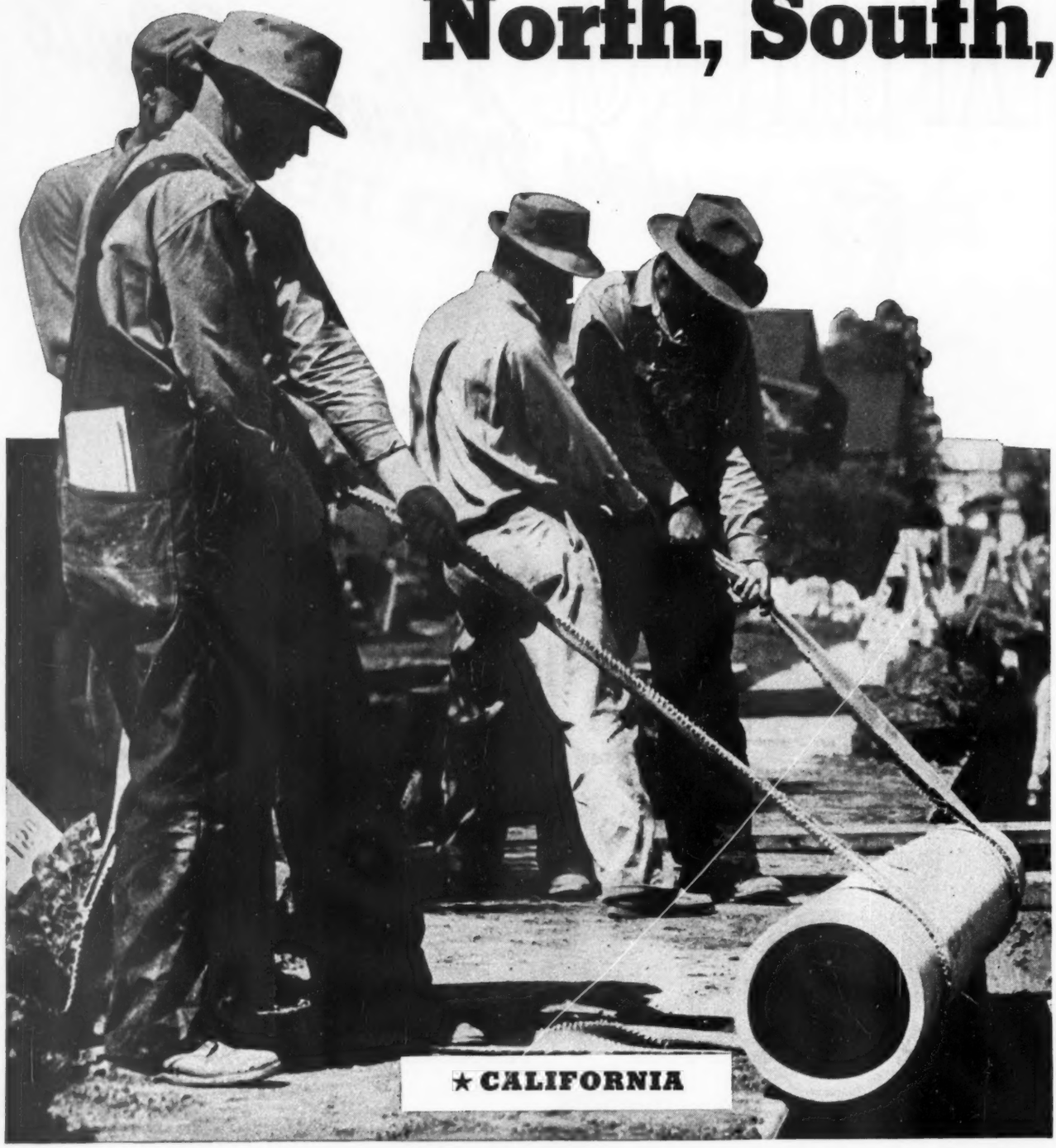
Water Works ..... *City* ..... *State* .....

DIAMOND ALKALI COMPANY • Standard Silicate Division

Plants at CINCINNATI · JERSEY CITY
LOCKPORT, N. Y. · MARSEILLES, ILL.
DALLAS, TEXAS

General Offices • PITTSBURGH, PA.

North, South,



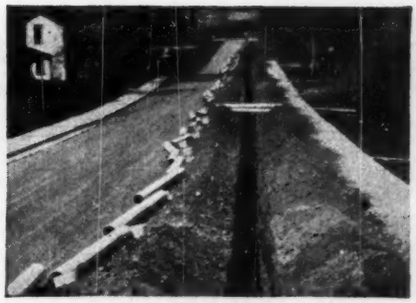
★ CALIFORNIA

★ TEXAS

★ NEW JERSEY

★ GEORGIA

East, West...



★ OHIO

THE PICTURES on these pages show a few of the hundreds of installations of *Transite Pipe for water lines* in cities, towns and villages, throughout the country. Proved in civilian service, virtually the entire production of Transite Pipe is now being used for the building of water transmission and distribution systems in military camps and bases.

Whether for civilian or military use, the following features of Transite Pipe mean efficient, low-cost water transportation.

Rapid Assembly. Even unskilled crews can form tight joints easily and quickly with the Simplex Coupling which requires no heating or pouring.

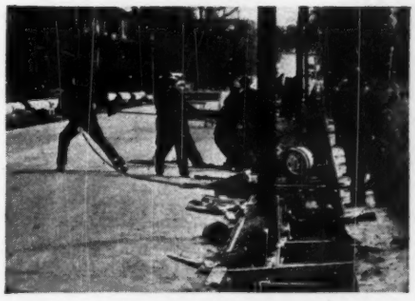
Easy Handling. Light-weight Transite Pipe requires fewer men for handling. Mechanical handling equipment is needed only for the larger sizes.

Tuberculation No Problem. Non-metallic in composition, Transite *cannot* tuberculate. Result—its initial high flow-coefficient (C=140) can never be reduced by tuberculation.

Tight, Flexible Joints. Wide sweeps can be made with straight lengths because the Simplex Coupling retains its tightness even when deflected as much as 5° at each joint.

Low Maintenance. Made of asbestos-cement, Transite's inherent corrosion-resistance and maintained strength are important features in contributing to low maintenance costs.

For details on Transite Pressure Pipe, write for brochure TR-11A. Information on Transite Sewer Pipe for lower cost sewage-disposal systems is available on request—brochure TR-21A. Johns-Manville, 22 East 40th Street, New York, N. Y.



★ VIRGINIA

★ MAINE

Johns-Manville JM

Transite Pipe

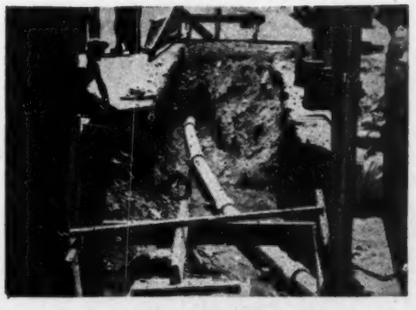
AN ASBESTOS PRODUCT

For efficient, economical water and sewer lines

★ WASHINGTON

★ NORTH CAROLINA

★ ARIZONA



★ CONNECTICUT

Chlorine Fights with the Fleet!
America is the United Nations' production line! Down that production line now comes an endless number of materials—supplies for our Navy, our Army, our Air Force and our Allies. Chlorine is helping produce them!
SYNTHETIC RUBBER
GASOLINE
EXPLOSIVES
TEXTILES
DYESTUFFS
TREATMENT of WATER
PLASTICS
SOLVENTS
STERILIZATION
MOTOR COOLING FLUIDS
HIGH PRESSURE LUBRICANTS
SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company

Calgon treatment *WORKS*

— in any of these waters!

SCALE prevention and corrosion control *used to be* a merry-go-round of troubles. Solving the scale problem often introduced corrosion —and safety from corrosion could usually be obtained only by forming scale. Now, Calgon *ends* this dilemma — solves four major treatment problems *without causing new ones.*

Soft corrosive water riddles piping and plagues consumers with "red water." Adding alkali to retard corrosion by means of a scale coating usually forms too much scale in lines near the plant and not enough at farther points. Calgon works differently. It maintains a thin, protective film over pipe metal and metal oxides throughout the system and reduces the attack of oxygen so effectively that corrosion ceases to be a serious problem and "red water" is eliminated.

"Red water" also results from precipitation of dissolved iron from well water, upon exposure to air, where the dissolved iron exceeds 0.3 ppm. Iron removal equipment is usually not employed unless dissolved iron exceeds 1 ppm., and even then it is not uncommon for "red water" to continue because of corrosion induced by oxygen dissolved in the water during the iron removal process. The best procedure is to add Calgon to well water as it is pumped. This prevents precipitation of dissolved iron and eliminates "red water" and the need for costly removal equipment.

Lime-soda softened water, after filtration, usually contains excess calcium carbonate in solution. Unless this supersaturation can be effectively controlled, scale will form in water lines and hot-water heaters. Effective stabilization, with complete security from corrosion, can best be obtained with Calgon. Added after the softening process, it stabilizes water throughout the system, and eliminates precipitation of calcium carbonate scale in hot-water heaters.

Hard high-bicarbonate water causes scale in consumers' heating coils, tanks and hot-water lines. Calgon offers a simple, economic means of stabilizing water and eliminating scale from home water systems.

These are a few of the specialized applications of Calgon in the water field where the amount of Calgon required is extremely small—from 1 to 5 ppm., depending upon individual plant conditions. Write for complete information and a sample for making your own tests.

**Calgon is the registered trade-mark of Calgon, Inc. for its vitreous sodium phosphate products.*

calgon, inc.

HAGAN BUILDING PITTSBURGH, PA.

How we save $653 a year with Ferrisul . . . even though the war has postponed construction of a new plant

By ROGER C. HIGGINS, formerly Chief Chemist, Chillicothe Municipal Utilities, Chillicothe, Missouri; now Chief Chemist, Hannibal Municipal Water Plant, Hannibal, Missouri

THE war has forced us to postpone construction of a much needed new water plant here in Chillicothe, a town of 8,175 in north central Missouri. Outmoded and inefficient for modern water-treating methods as the old plant is, however, our situation could be much worse.

One of the basic faults in the design of our present plant makes it necessary to add all chemicals used as primary treatment for softening and clarification at one point, simultaneously. As a result, when we established our laboratory and started lime softening some seven years ago, we found that we could not get proper clarification under normal treatment using alum as a coagulant. Worse, on highly turbid waters (2,000 to 3,000 p.p.m.) we were using as much as 10.0 grains of alum per gallon and still not getting an effluent up to good standards.

Ferrisul Tested and Adopted

That was our problem when anhydrous ferric sulphate was first introduced several years ago under the name Ferrisul.

In the somewhat forlorn hope that the new coagulant might be the answer to our problem, we wrote for a sample. Laboratory tests on the varied types of water encountered in the surface stream which supplies our city were promising, so we ordered a ton and started a series of carefully controlled plant-scale tests. When we got even better clarification with even less Ferrisul than the jar tests indicated we would, we standardized on Ferrisul.

Saved—$2.70 Per Million Gallons

Over a period of 38 months, during which 766 million gallons of water were treated with Ferrisul, we cut our average dose from 2.18 grains of alum per gallon to 0.64 grains of Ferrisul. *Translated into dollars and cents, that has meant a saving of $2.70 per million gallons, or $653 a year — a reduction of 62% over the cost of alum treatment at a total cost of $90 spent to equip two old dry feeders to handle Ferrisul!*

In addition, the quality of water produced is noticeably better. The pH is much easier to control due to the small amount of coagulant added. And turbidities are lower, both in the water going to the filters and the effluent.

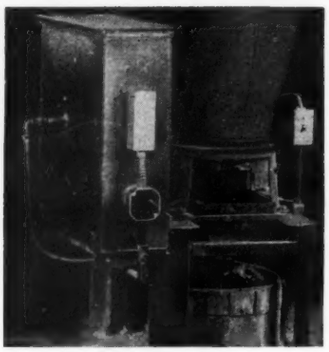
Adequate Service Without Re-building

That's why I say that even though we must continue to do the best we can with an outdated plant "for the duration," our situation could be much worse. *With the use of Ferrisul we have greatly increased our efficiency, lowered our costs and markedly improved our results so that we can continue to give our community adequate service even without the new construction we would otherwise so sorely need.*

What 76 Months and 1,423,000,000 Gallons Revealed

	m.g.* treated	gr./gal.	cost per ton	cost per m.g.
Alum	657	2.18	$28.00	$4.35
Ferrisul	766	0.64	$36.70	$1.65

*The figures on Ferrisul are based on the first 38 months it was used and the alum for a like period just prior to the use of Ferrisul. Over such a long period, seasonal variations equalize each other so no special note is given on the types of water encountered.



Mr. Higgins converted two old dry feeders at a total cost of $90 to handle Ferrisul. A vertical 1/6 h.p. motor drives the lead-lined solution pot stirrer. Flow from the 20-gallon water tank fastened to the feeder, is controlled by an ordinary flush box float valve. In the end of the tank, near the bottom, is a 3 K. W. immersion heater. At the end, just below the water line, is a slightly altered strap-on thermostat. A vapor-tight lid prevents steam from condensing on surrounding machinery. Two feeders, so equipped, have worked perfectly.

☆ ☆ ☆

Can Ferrisul Help Solve YOUR Wartime Problems?

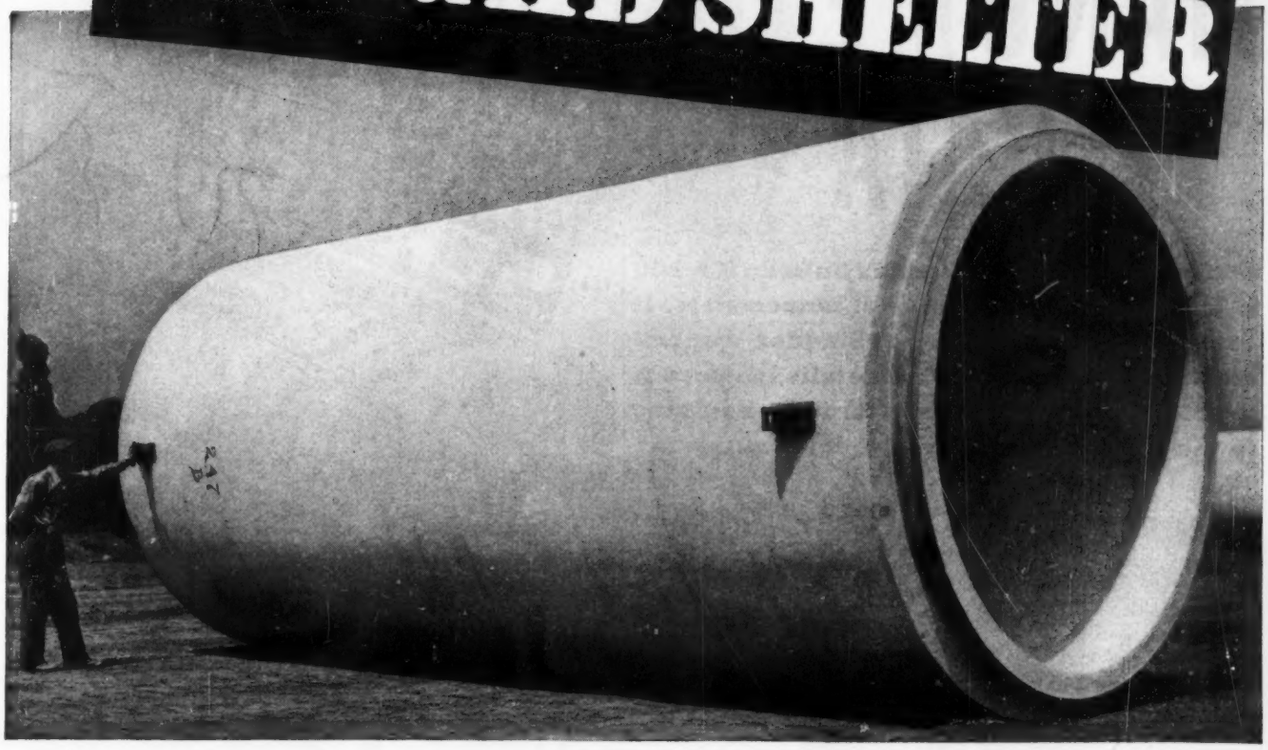
In many water and sewage plants facing many different problems Ferrisul is helping to maintain efficient, effective operations . . . in some cases where greatly increased wartime loads are straining plants even beyond their designed capacity . . . in others where wartime shortages of construction materials have delayed badly needed modernization programs. Dry and free-flowing Ferrisul is easy to handle and store, will not cake in storage and requires no expensive equipment for proper application.

For details on the full line of Monsanto water-treating chemicals and experienced technical advice on your particular water or sewage-treating problems, inquire: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston, Massachusetts.

MONSANTO CHEMICALS
SERVING INDUSTRY . . . WHICH SERVES MANKIND

FERRISUL
for better, more efficient water and sewage treatment

AIR RAID SHELTER



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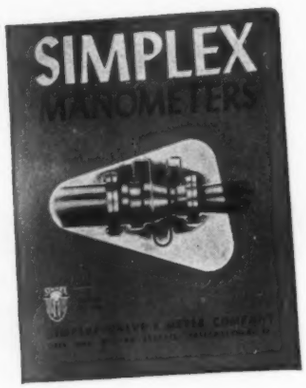

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8	3100	....	....	....
10	2580	....	....	....
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16	2120	3920	5150	....
18	2030	4050	5280	....
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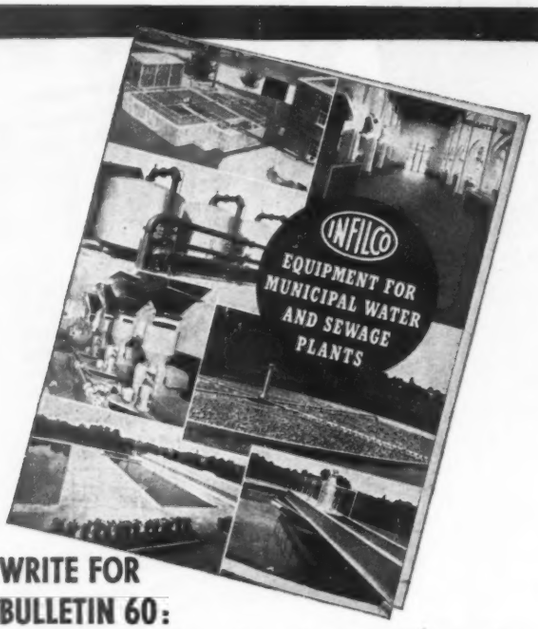

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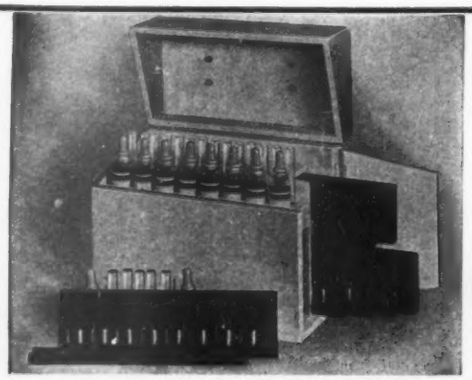

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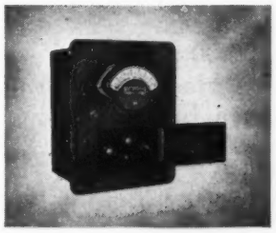

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"Meetings Reports"

We regret the necessity of having to postpone until our next issue reports covering the annual meetings of—

The Kentucky-Tennessee Section.
The North Carolina Section.
The Virginia Section.

In this issue are to be found reports covering—

The Sewage Works Federation Wartime Conference.
The Southwest Section.
The Four States Section.

"Elevated Tank Maintenance and Repairs"

Never was America more conscious of maintenance, so WATER WORKS AND SEWERAGE is making a particular effort to give its readers timely and up to date information and pointers on effective repair and maintenance practices. We heard the author of this article speak informally on tank maintenance so we prevailed upon him to put his comments and suggestions on paper. He is—

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"The Removal of Oils from Plant Wastes"

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ROLF ELIASSEN* and CLAIR N. SAWYER,
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(*Now Captain in the U. S. Engineers)

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Is the interesting story of an experience in "total metering" by Warsaw, N. Y., and the result. To any water works manager who may be concerned over supply deficiencies in the period ahead, and the increasing difficulty of securing plant extensions and additional facilities, the Warsaw story may prove just the needed formula. It comes from—

GERALD F. SHEEHE, Supt. of Works,
Warsaw, N. Y.

"An Operating Log for a Small Sewage Plant"

Is the subject of a brief description of the keeping of a small sewage plant operating log and a reproduction of a suggested log form developed from experience. The producer is—

A. A. HIRSCH, Sanitary Engineer,
State Dept. of Education, Baton Rouge, La.

VOL. 89, NO. 11 NOVEMBER, 1942

CONTENTS

Sewage Plant Maintenance 457
By Stanley J. Larsen, Mechanical Engineer, Minneapolis-St. Paul Sanitary District, Minnesota.

Southwest Section's Wartime Conference 465

Wartime Conference of The Sewage Works Federation 474

War Time Water Conference of Three Associations 488
By Harry A. Faber, Associate Editor.

Snapped during A. W. W. A.'s Wartime Conference 492

Bacteriological Results of Break-Point Chlorination 494
By Albert E. Wilson, Jr., Supt. of Filtration, Fredericksburg, Va.

The Determination of High Chlorine Residuals 496
By N. S. Chamberlin, San. Chemist, Technical Service Division, Wallace & Tiernan Co., Inc., Newark, N. J.

Editorial 500

Meetings Scheduled ..... Ad. Page 73

Literature and Catalogs Received ..... Ad. Page 75

Equipment News ..... Ad. Page 77

Manufacturers' News ..... Ad Page 80

H. P. Gillette, President; E. S. Gillette, Vice Pres. and Publisher; L. H. Enslow, Vice Pres. and Editor; John C. Black, Managing Editor; Associate Editors — J. R. Baylis, A. M. Rawn, H. A. Faber; H. J. Conway, Make-Up Editor;

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Water Works & Sewerage is a monthly publication. Single Copies, 25 Cents; Subscription Rates U. S. and Canada, $2.00 per year; Foreign, $3.00 per year.

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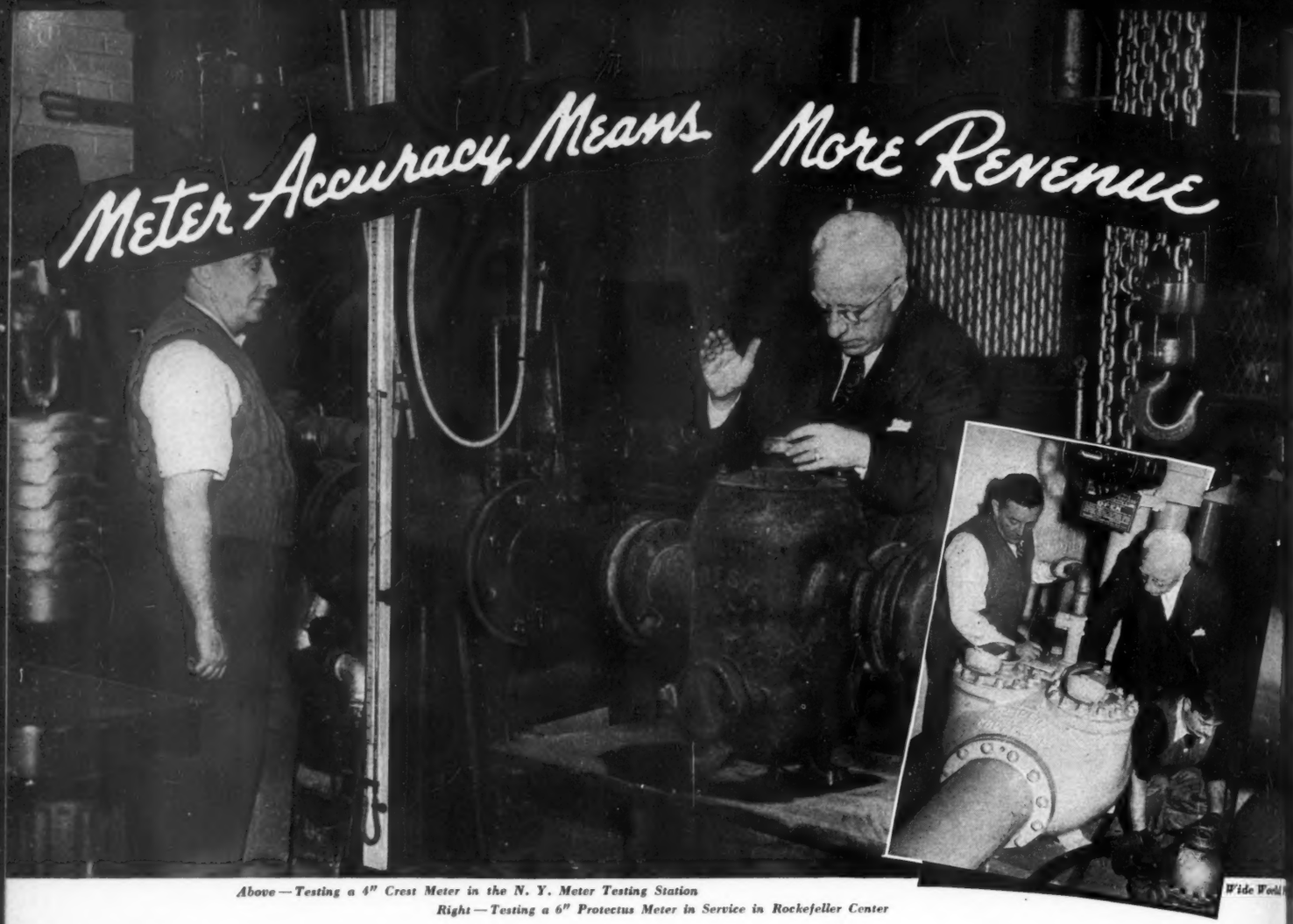


Above — Testing a 4" Crest Meter in the N. Y. Meter Testing Station
Right — Testing a 6" Protectus Meter in Service in Rockefeller Center

Wide World

A HUNDRED YEARS AGO thousands of New Yorkers flocked to City Hall Park to see the fountain display fed by the newly opened Croton Aqueduct. New Yorkers of that day were proud of their new System, which DeWitt Clinton had outlined in 1833 to deliver 20,000,000 gallons a day.

One hundred years later New York City's water supply system delivers an average of 880,000,000 gallons daily. The City now covers the whole of Manhattan Island and has spread out to include four other boroughs.

Today one of its greatest attractions is Rockefeller Center, business headquarters of thousands and the mecca for additional thousands of visitors. Deep in the sub-basements, never seen by the public, are [illegible] meters which record the daily wate[illegible]rements of [illegible] population.

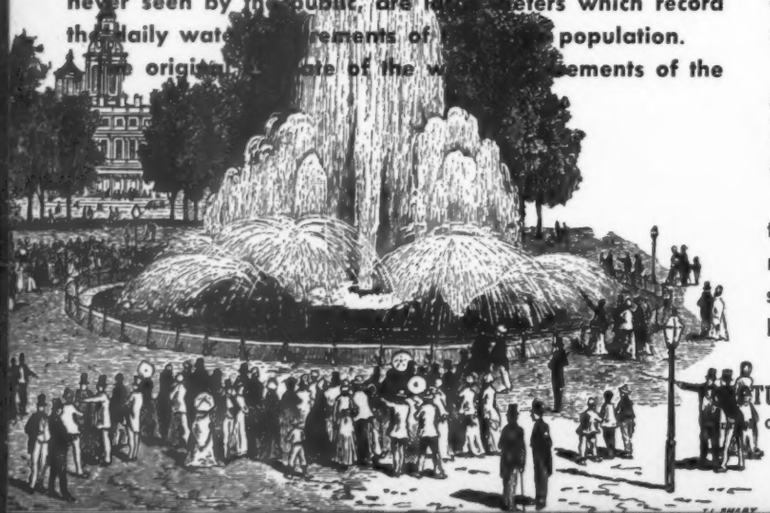
[illegible] original [illegible]ate of the w[illegible]sements of the RCA building alone contemplated a demand rate of 20,000,000 gallons a day — equal to the original estimated capacity of the Croton System.

This demand would have put such a burden on the present system that engineers devised a way of using water over and over in the cooling and air conditioning systems so that the requirement was cut to ⅓ of the original estimate.

Just what do meters mean to a city like New York? Of the 667,400 connections in New York City, 179,600 are metered, a large percentage in the larger sizes. From these metered services, which consume 22 per cent of the water, the City receives $16,400,000 or 42 per cent of its water revenues. But should these meters under-register as little as 3 or 4 per cent, the City would lose a staggering amount of money.

This is striking proof that meters should be tested regularly, and that every city, as does the City of New York, should maintain a thoroughly equipped meter testing shop.

In these days of increasing cost in every phase of our life, the efficient Water Department cannot afford to lose revenues through under-registration of meters. Regular and systematic testing of all meters is the only safeguard against loss.



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WATER WORKS & SEWERAGE

VOL. 89, No. 11 *A Gillette Publication* NOVEMBER, 1942

SEWAGE PLANT MAINTENANCE

Some Experiences and Practices Developed at the Twin-Cities Plant

By STANLEY J. LARSEN
MECHANICAL ENGINEER
MINNEAPOLIS-SAINT PAUL SANITARY
DISTRICT, MINNESOTA

THE maintenance of sewage plant equipment has, in the past, probably been unusually costly because the equipment generally has been adapted from other industries and in sewage treatment, which is relatively new, engineers and manufacturers have had to cooperate and experiment with existing equipment in order to develop something suitable to new requirements. This constant developing and improving should be the procedure under which any maintenance problem is attacked. To "keep up" equipment does not necessarily mean to contend with a repeating condition. Thought should always be given to correcting the cause.

The problem of maintenance should not be considered in any different aspect regardless of the plant size. The importance of this work is equal to that of satisfactory operating results, and ample funds should be provided for execution of maintenance.

Never before has proper maintenance taken on the same magnitude of importance as it has at this time of scarcity of materials and replacement parts.

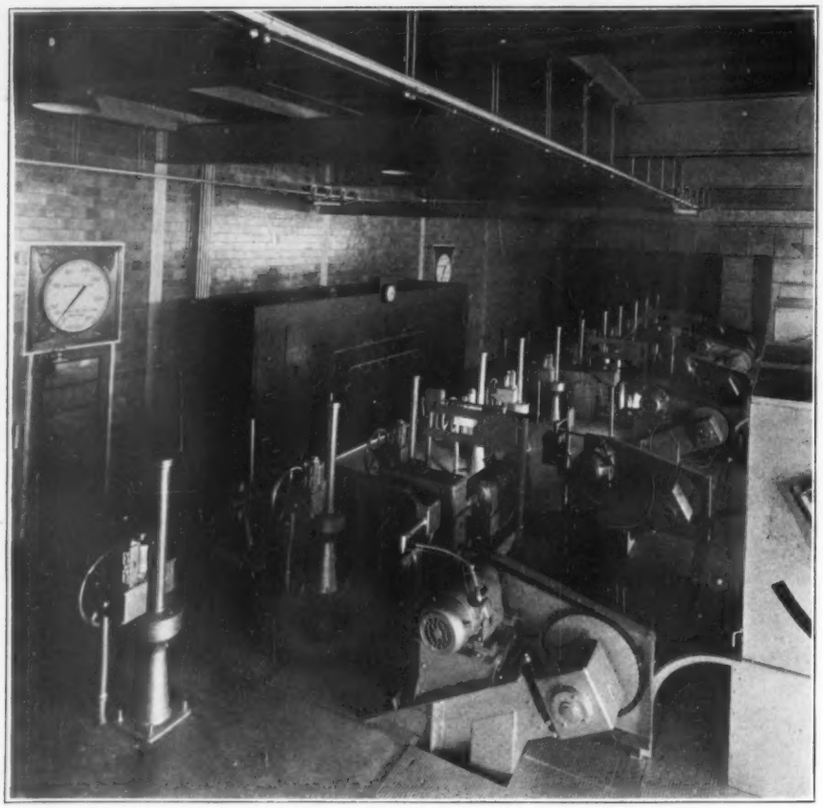
Proper facilities and personnel for maintenance work should be provided regardless of plant size. Where the plant size does not warrant full-time maintenance personnel or shop facilities, the locality should be examined for a possible source of these fundamental requirements.

Scheduling and Substitution

Any discussion of maintenance procedure should also include the advantages and disadvantages of scheduled overhauling of equipment. Where critical equipment may leisurely be dismantled, cleaned and worn parts replaced, there is no question that peace of mind results. This may not always be economical or feasible,

General View, Sewage Treatment Plant of the Minneapolis-St. Paul Sanitary District.

(Designed to provide chemical treatment and mechanical filtration of effluent during low stream stages.)



The Screen and Grit Room—Twin-Cities Plant.

depending on what standby equipment is available or if periodical shutdowns are permitted. Where standby equipment is available, it is perhaps more economical to get the maximum life out of the equipment before shutting it down for repairs. However, emergency shutdowns should always be anticipated. Critical parts should be on hand and procedures for contending with emergency shut-downs should be rehearsed.

The present-day importance of maintenance work from the standpoint of availability of labor and material and the vagaries of the priorities system should also be considered. Many materials and repair parts will, because of our present national emergency, be unavailable. This calls for the utmost skill in careful operation and ingenuity on the part of plant operators in devising substitutes for both material and methods.

It is impossible in a discussion of this nature to touch on all the problems encountered in the maintenance of sewage plant equipment. There are new ones every day. However, by describing some of the problems encountered at the St. Paul-Minneapolis Sanitary District and how they were solved, it is possible that our experiences may serve as a guide to someone else. Some of the common maintenance problems are, of course, screens and grit removal equipment, the machinery of sedimentation and sludge disposal units and pumps. Electrical and meter maintenance and the universal problem of painting are subjects which are also of vital interest.

Screening Equipment

The equipment first to be discussed in sewage treatment is naturally screens and screenings handling machinery. Hand-cleaned screens or basket type screens, of course, need very little maintenance other than a protection against corrosion. Screens with power-driven screen cleaners are usually a source of some trouble, however. At the Sanitary District plant the major part of the work with screens of this type has been the correction of original design. This has consisted of strengthening and bracing the rake arms and installing a more rigid rake cleaner and new and more effective shock absorbers. The shear pin arrangement has been revised to provide a speedier installation of replacement pins. After 2½ years of operation it was found necessary to install new chains. The cause of the undue wear of these chains has been, in part at least, the tendency to keep the chains too tight. This has also caused excessive wear on the lower chain guides, of which several have been resurfaced.

The disposal of screenings at the Minneapolis-St. Paul plant consist of removal from the screens by means of conveyor belts to a loading area where they are loaded on trucks and removed to a dump. The problems encountered with this type of equipment are not serious, although conveyor belts will be discussed later in this article.

Grit Removal Equipment

Grit chambers with equipment for the continuous removal of the grit are usually a source of constant maintenance. Grit by its very nature is abrasive, and abrasion means maintenance. At the Sanitary District plant grit is settled in channels or chambers immediately following the screenings removal. The equipment consists of scrapers or collectors in the chambers for depositing the grit in one end. Here it is elevated out of the chamber by means of a screw conveyor and deposited on a belt conveyor. From the belt it is again elevated to a loading bin by means of bucket elevators. Every item of equipment in this system has needed more or less attention because of the abrasive nature of this material. The collectors in the chambers consist of the usual chain and sprocket arrangement with cross flights or scrapers. The replacement of wearing shoes on the scrapers has been the greatest item of maintenance with this equipment to date. Serious wear, however, is now developing in the chain and sprockets. The chain will have to be replaced eventually but the intention is to rebuild the sprocket teeth by means of welding. A hard bronze welding rod is used for this, and with reasonable skill and a tooth template these teeth can be successfully rebuilt in place. The saving in this method is obvious.

The screw conveyors used in elevating the grit out of the chambers have presented the greatest problem in maintenance. Here again improvements in the original design have resulted in tremendous savings. The bearings supporting this screw conveyor in the trough were originally greased babbitt bearings and their maximum life was anticipated to be approximately two months. A new bearing, however, was developed at the shop of the Sanitary District which consisted of a hard-surfaced shaft revolving in a bronze bearing. The ends of the bearing were sealed with rubber and water pressure is applied to the bearing surface. This water escapes around the rubber seals and provides not only some lubrication but an effective method of keeping the

grit from entering the bearing. The life of these bearings has been increased to average two years' service.

The Author

Conveyor Belts

The next item of equipment in the system of grit removal is the conveyor belt. Rubber is unquestionably one of the best abrasion-resisting materials, but the severity of conditions under which this belt operates is beginning to show on the belt surface. Rubber wipers which must be used to keep the return side of the belt clean must be constantly replaced. A high abrasion-resisting type rubber has been adapted for this purpose.

The grit elevator has also been re-designed. This elevator consists of rubber belt to which cast iron buckets are attached. It was necessary to revise the type of bearing used on the lower pulley, substituting a sealed type roller bearing in place of the original babbitt bearing. A more recent improvement on this piece of equipment has been to line the entire elevator housing with used rubber belting in order to eliminate abrasive wear caused by the falling and splashing sand.

Pumps—Sewage and Sludge

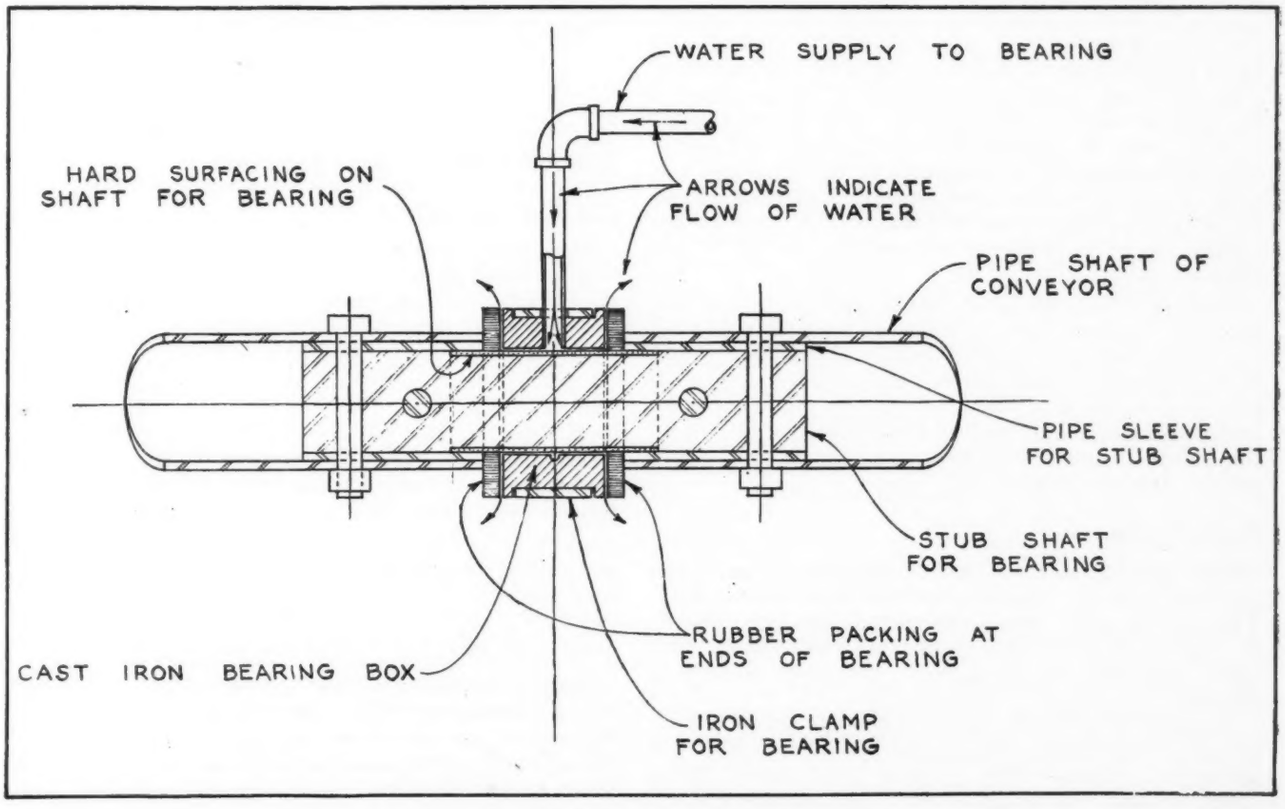
Sewage pumps operating continuously should be selected and maintained from the standpoint of high over-all efficiency. Sewage, even though screened, contains a high percentage of stringy material which can be a source of continued annoyance in pumps. Pumps for sewage should be of the closed impeller type with specifications for the minimum size solid to be passed. Wearing rings should be incorporated in sewage pump design and should be inspected and maintained to a reasonably close clearance. With other parts properly designed, the wear of wearing rings can be the key to poor pump efficiency. At the Sanitary District plant wearing rings are machined from stock bronze cast into cylinders especially for this purpose. Sealing the sides of sewage pump impellers with clean water has been a means of increasing the life of wearing rings and raising pump efficiency.

Sludge pumps as used at the Sanitary District plant are the reciprocating plunger type. At the beginning of operations, certain fundamental weaknesses were discovered in the design. New parts were made at the plant shop and since then very little maintenance has been needed. New plungers were made from castings designed by the Sanitary District. These were made heavier and of a stronger material. The costs of these parts were $6 for the castings and approximately $12 for the machine work, or a total of $18.

Packing and packing sleeves constitute a major source of trouble in centrifugal pumps. High-grade well lubricated soft packings are generally recommended, but proper adjustment of packing glands and the application of seal water constitutes the answer to most of

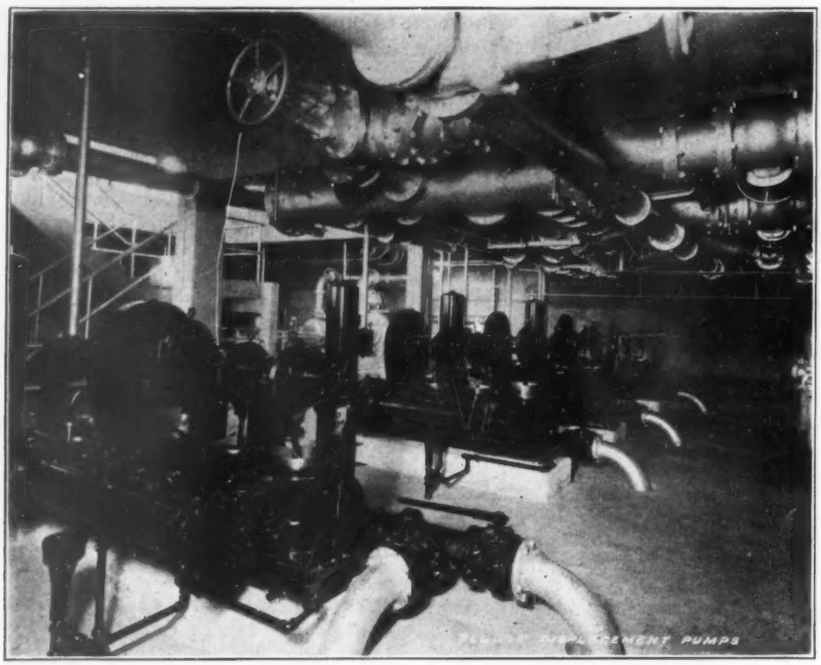
This paper, presented before the Central States Sewage Works Association, was written by prearrangement for publication in "Water Works and Sewerage." In consequence, it has been released by the Editor of Sewage Works Journal for its present use.

Since the preparation of this paper the author has been granted leave of absence for the duration by the Minneapolis-St. Paul Sanitary District to accept a commission as First Lieutenant in the U. S. Air Corps, which he is now serving.


WATER SUPPLY TO BEARING
HARD SURFACING ON SHAFT FOR BEARING
ARROWS INDICATE FLOW OF WATER
PIPE SHAFT OF CONVEYOR
PIPE SLEEVE FOR STUB SHAFT
STUB SHAFT FOR BEARING
RUBBER PACKING AT ENDS OF BEARING
CAST IRON BEARING BOX
IRON CLAMP FOR BEARING

Intermediate Bearing for Grit Screw Conveyors.

(Developed in the shops of the Minneapolis-St. Paul Sanitary District. For description see text.)



Twin-Cities' Battery of Heavy Duty Sludge Pumps.

the trouble. When sealing water is applied to packing, consideration should be given to the conditions under which the pump operates. When sealing against a vacuum or high suction, the lantern ring should be kept out as close to the gland as feasible; this will insure a small amount of water flowing both ways from the lantern ring, keeping the packing well lubricated and maintaining a good seal. On the other hand, when sealing against a pressure the sealing water should be applied near the bottom of the stuffing box. This will again keep the entire packing lubricated and also keep a flush of clear water into the pump to keep grit-laden water from entering the packing. Keep packing gland nuts as loose as possible for long packing and sleeve life. Vibrations due to unbalance of the impellers will cause excessive packing replacement. Balancing of impellers and shafts is carefully watched at the Sanitary District plant in order to obviate the results of unbalance.

Vertical sump pumps, of which there are 17 at the Sanitary District plant, have caused very little trouble. On submerged type pumps, with enclosed shafts and packing glands, a clear water connection was added to the shaft housing to insure clean water through the bottom bearing. This has increased the life of two of the pumps in particular from two months to approximately eighteen months.

Tank Mechanisms

Settling tank mechanisms of the type in use at the Sanitary District plant require but little maintenance. The settling tanks are of the rectangular type, 290 ft. in length. Each collector pass is 18 ft. in width. The tanks are also equipped with automatic skimming devices.

Wearing shoes on the most frequently operated tanks showed considerable wear at the end of two years of operation. Several were replaced with locally made shoes of similar design at a cost of approximately $1.65 apiece. Since then, however, a method has been developed whereby these shoes are hard-surfaced by spot welding with "Hasteloy" in place at a cost of approximately 20 cents apiece.

Sprockets in the settling tanks have recently shown considerable wear. Experiments have proven that these can be successfully renewed in place by means of building up the worn teeth with welding rod.

Proper attention should be given to chain drives. Proper lubrication and chain tension is important for longer chain and sprocket life. In the original design of the settling tank drive mechanism no chain tightener was provided. Continued chain breakage in this drive resulted in the installation of chain tighteners and since then no breaks have been experienced. Settling tank motors and gear reducers should be adequately protected by shear pins.

Gear reducers and transmissions, of which the Sanitary District has numerous types, should cause little trouble if properly lubricated and not overloaded. This equipment is usually precision machined and is designed for more continuous and severe conditions than is normally found in sewage plants.

Gates and Valves

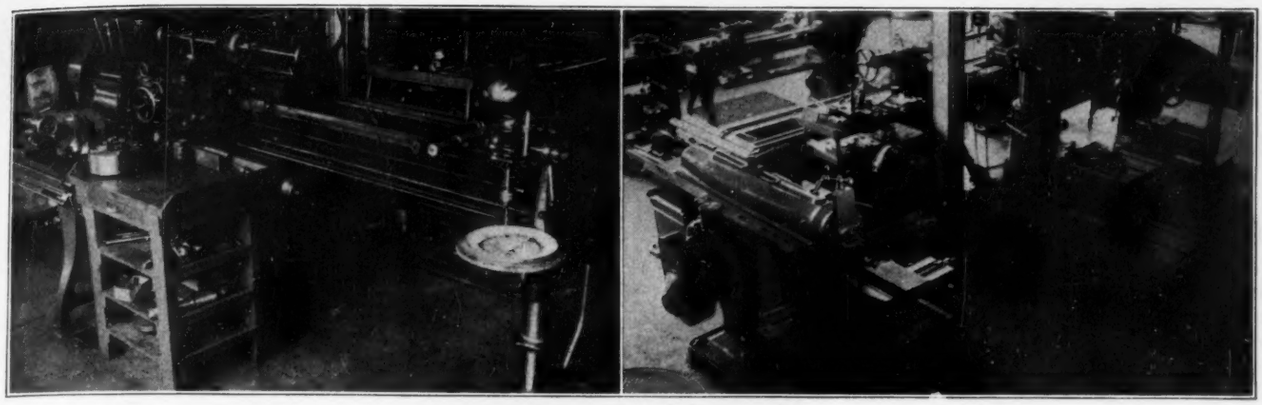
Sluice gates which are common to both settling tanks and grit chambers are carefully inspected twice each year. Gate guides, wedges and steam fastenings are checked. The gate seats are also checked for tightness.

The gate gearing is carefully watched for lubrication. A recent inspection showed an accumulation of dirt in the oil on one type of gate operating mechanism used at the Sanitary District plant. All the gear cases (of which there are 37) are being removed and the parts thoroughly cleaned and inspected.

Concrete Structures

The maintenance of outdoor concrete construction, such as settling tanks and digesters, has, under certain conditions, presented some problems. Some deterioration noted has been due to the action of sewage acids on the alkaline ingredient of the concrete. Acid-resisting paints have proven very satisfactory in the retardation of this action. The most common source of concrete deterioration, however, is the result of repeated freezing and thawing. The original design of concrete structures should eliminate as much as possible all surfaces where water may accumulate. However, where spalling has become evident they may be patched with any of the several recognized materials for this purpose. Several of these materials have been tried by the Sanitary District with satisfactory results. Their application is relatively simple and inexpensive.

Sewage aeration generally presents little in the way of maintenance problems. Blowers of the positive displacement type are almost universally used, not only for sewage treatment but in numerous other industries. Their rugged dependability is generally accepted. Clean air supply and proper lubrication is usually all that is needed for a long life in this equipment.



Shop Views—Twin Cities Plant

(1) *On left a rebuilt pump impeller and shaft is being turned down in the 26 inch lathe and a pump case is on the drill press to right.* (2) *On right is a sharper and radial drill.*

Sludge Dewatering Equipment

Sludge dewatering such as incorporated in the Sanitary District presents numerous maintenance problems. Briefly, the procedure is as follows: Sludge of approximately 6 per cent solids from the settling tanks is pumped to concentration tanks equipped with scraper mechanisms. From the concentration tanks the thickened sludge (8 to 10 per cent solids content) is elevated by a bucket elevator to conditioning tanks, where lime and ferric chloride are added. The sludge is then piped to vacuum filters, where the moisture content is reduced to an average of 65 per cent. Sludge cake is conveyed by means of conveyor belts to the multiple hearth incinerators.

The great variety of equipment needed in sludge dewatering has caused this phase of the treatment to be one of the most expensive from the standpoint of both operation and maintenance.

The maintenance of the concentration tank scrapers are, of course, similar to either grit chambers or sludge collectors. Here wearing shoes may have to be resurfaced even a little oftener than those in setting tanks, as they are operated oftener and in more abrasive material.

The sludge elevator has up to date been overhauled approximately every eighteen months. This work has consisted of replacing chains, bucket attachments, and in some instances the sprockets. A revision in the type of bucket attachment is contemplated and this may eliminate some trouble.

Conditioning tanks and the attending chemical handling and proportioning present many unusual maintenance problems. Conditioning tanks as originally installed were revised somewhat in regard to the air agitators and the methods in which chemicals were introduced. Maintenance, however, consists mainly in the battle against corrosion, which is unusually severe.

Chemical handling consists of a pneumatic elevating system to bring chemicals from railroad cars up to storage bins. From the bins it is handled through feeders which are controlled through intricate electrical systems in order to feed chemicals in proportion to the sludge elevated to the filters. Many changes were made in the original design of this equipment and the low dosages of both lime and ferric chloride which are now being used at the Twin Cities plant are to some extent the result of these changes.

The vacuum filters have given relatively little trouble. The screens covering the filters became plugged with lime deposits and for a while the only practical way to clear them was found to be to remove the screens and have them sandblasted. The wooden framing of the filters finally became coated with this same lime deposit and the possibility of removing this accumulation of lime with hydrochloric acid was considered. The procedure developed consisted of filling the filter pan with a known quantity of clear water and then adding inhibited hydrochloric acid in sufficient quantities to give a desired strength. The filter drum was then revolved and the lime-coated portions of the filter were repeatedly subjected to a submergence in acid and gradually the deposits disappeared. This procedure has now become a routine operation. It has been described in some detail by our Chief Chemist, K. L. Mick, in an article in WATER WORKS AND SEWERAGE for July, 1942.

Vacuum pumps used as appurtenances to the filters are of the positive displacement reciprocating type. After a few months of operation it became evident that the problem of keeping valves clean was to become a sizable maintenance job. The problem was presented to the manufacturer, who concurred with the Sanitary District's determination that the material deposited on the valves was a combination of saponified oil and lime. The corrosive action of this mixture soon pitted and rusted steel and cast iron valve parts to the extent that they had to be replaced. The manufacturer then supplied the Sanitary District with a trial set of valves and valve springs made of a stainless steel alloy. These valves proved very satisfactory and subsequently a set was bought for each machine. Several spare sets have since been purchased. The maintenance procedure on vacuum pump valves now consists of keeping a spare set of valve cages completely cleaned and assembled ready to install in any machine which may need this attention. A set of valves now lasts from four to five months as compared to maximum life of one month when operation first began.

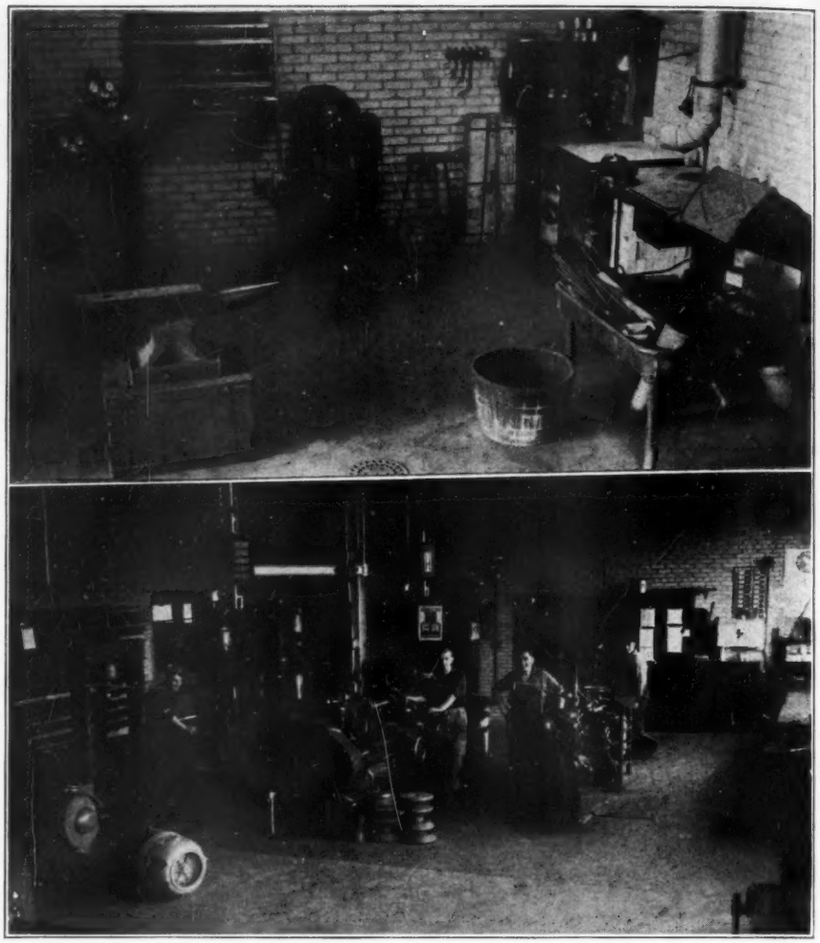
Conveyor Belts

Conveyor belts when handling sewage solids may become deteriorated due to the grease content of the material. This condition became apparent at the Twin Cities plant. The remedy for this was found to be in turning the belt over and applying powdered soapstone to the under side of the belt. This has preserved belts to the extent that one belt considered useless two years ago is still giving good service.

Belt alignment is an important matter from the standpoint of belt life. After some experience with various belt aligning idlers the so-called compensating type has been selected and is giving exceptionally good service.

Incinerators

The incineration of sewage solids and the ash disposal equipment constitute the equipment of greatest maintenance cost at the Sanitary District. They are, however, lower per doller value of equipment than other equipment at the plant and as low as one-third the cost of similar equipment used at other plants. Incinerators in operation at the Sanitary District plant are the rabble type multi-hearth furnaces. Three of these incinerators and the appurtenant equipment constitute a large demand for maintenance service. Here again revisions have been made in the original design in order to adapt this equipment to existing operating conditions. The furnace as originally designed incorporated the use of air preheaters. Thermal balances indicate that these preheaters are not necessary for operation and in order to avoid the constant cleaning of these units and impending major repairs, these units were removed on two incinerators and will be on the third at an early date. A power saving of approximately $5,000 per year has also been shown due to the elimination of the hot air fans.



Welding Equipment and General Shop View.

View at bottom is one section of the machine shop. Above is the welding corner in the shop, showing both oxy-acetylene and arc-welding sets which have proven so useful and economically successful in maintenance and repair work.

Electrical Equipment

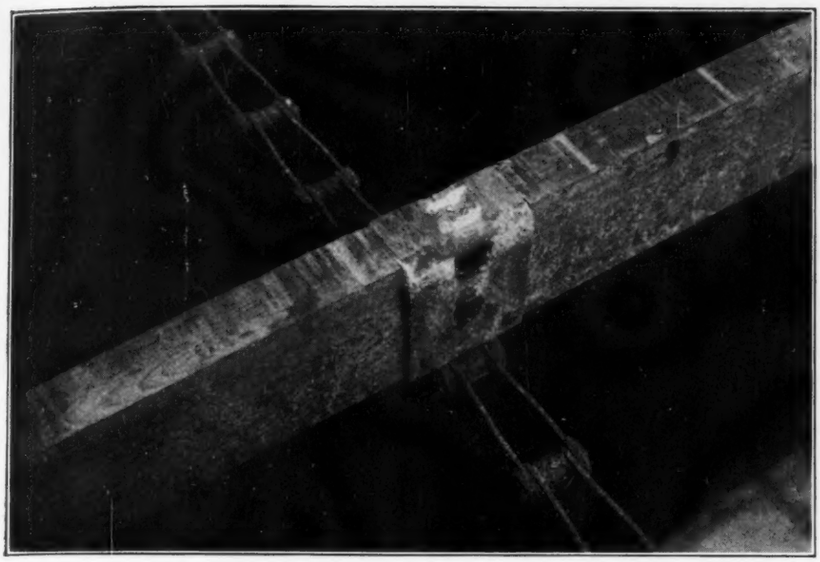
Maintenance of electrical equipment must necessarily be mainly preventative maintenance. This is usually in contrast to mechanical maintenance where the extent of wear may be observed and a certain degree of wear tolerated. When depreciation of electrical equipment first is in evidence, failure of some vital function has already occurred. At the Sanitary District plant a procedure of checking certain remote and vital equipment is made mainly from the standpoint of its functioning electrically. A periodic inspection of motor starters, switches and circuit breakers is made. Insulation breakdown tests are made of critical power feeders and motors in damp locations. An extensive motor inspection program has recently been in progress at the Sanitary District. This program was started because of irregularities in the lubrication of motors. The possibility of excessive lubrication of motor bearings can become more serious than under lubrication. Grease, if allowed to enter motor winding, can cause deterioration of insulation and eventually a complete failure. On the other hand, a burnt-out bearing is not nearly as serious as a motor re-wind job caused by grease.

Meters and control apparatus which are used for accurate operating information constitute a separate maintenance problem. At the Sanitary District plant operating deficiencies have been discovered and economical changes in the methods of operation have been accomplished from the accumulation of metered data. The importance of keeping this equipment in good repair is evident. A schedule of inspection and checking is maintained, and if nothing else is needed the equipment is always cleaned and lubricated. Many types of meters are used at the Sanitary District plant. They include sewage flow meters. Sludge flow meters and liquid level indicators all provide remote indication.

Continuous Sludge Scales

Scales for the continuous weighing of sludge cake on belts incorporate delicate mechanisms that must be constantly checked and maintained. An interesting application of a flow meter installed by the Sanitary Distric is the automatic control of a series of pumps. By means of the differential in pressure set-up by an orifice in the discharge line the meter automatically starts and stops pumps as flow increases or decreases. Control equipment of this nature which is vital in successful operation of the plant must be checked constantly and properly maintained.

Automatic emergency by-pass gates, which are extremely critical, must be constantly checked. The remote control and indication of their operation constitute an elaborate electrical system which must function in every detail.



Another Job Done in Place at Marked Savings in Replacement Costs.

The wearing shoes on tank scraper arms are hard surfaced by spotting with "Stellite." Note the two bright wear-resistant beads. For details and economy effected see text.

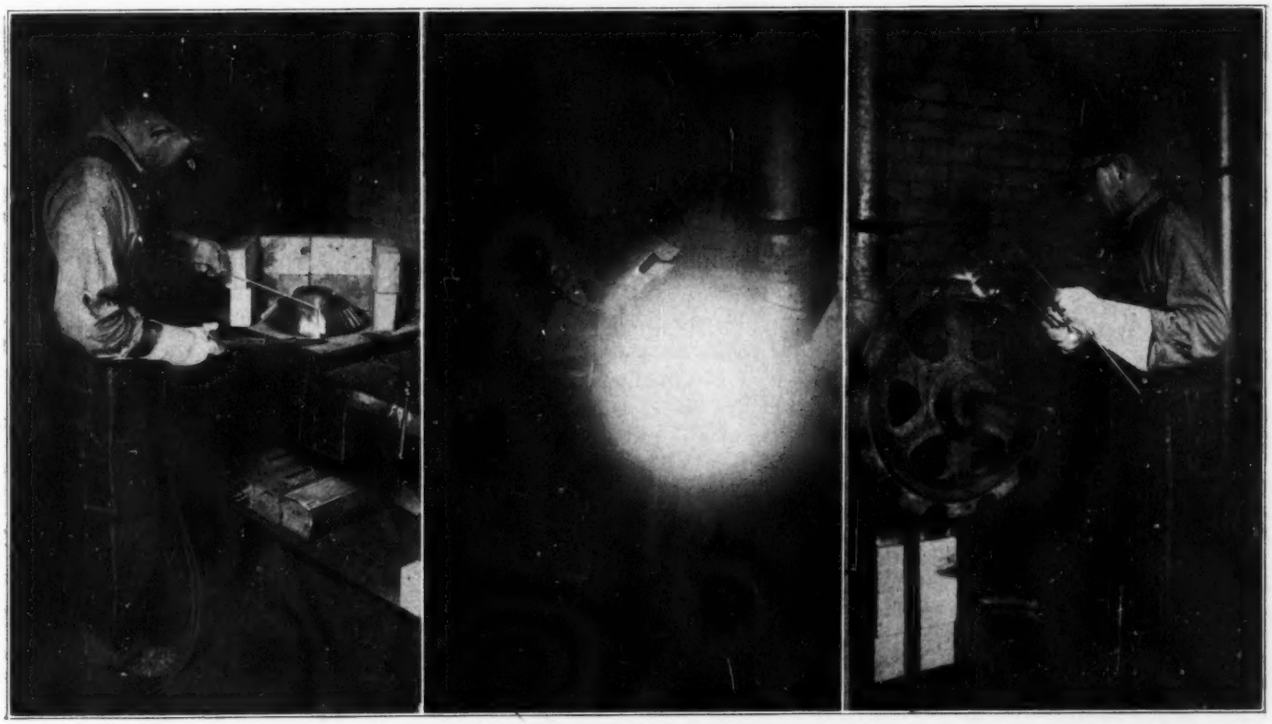
Painting

Much has been written and said regarding painting in and around sewage plants. It is apparent that paint deterioration varies to some extent with the type of treatment employed. Where corrosive gases are liberated and excessively moist conditions prevail, paint renewal must necessarily be oftener.

The first important requirement in the application of any paint is the preparation of the surface. This cannot be over-emphasized. If the surface has never been painted before it should be thoroughly cleaned and dried. A device has been developed using an acetylene and oxygen flame for the preparation of surfaces for the application of paint. This device can also be used for removing old paint and the method described in the October issue of this magazine is known as "Flame Priming."

The paint formulae developed by the Sanitary District consisted mainly of the use of a Tung oil varnish as vehicle and a metallic pigment such as aluminum or iron oxide. These paints have proven very satisfactory and paint failures that have occurred can generally be traced to faulty application or poor preparation of the surface. At present both Tung oil and aluminum paste are strategical materials and are not available. Substitutes are being tried, especially for interior uses. These consist mainly of the use of enamels both of synthetic and oil base. These enamels have proven very satisfactory, so far, and have an advantage over flat paints in that enameled surfaces are easily cleaned.

The application of paint should not be determined solely from the standpoint of protection of surfaces. The pleasing appearance of well-painted equipment or buildings can do much to counteract the popular repulsive stigma attached to the name "sewage treatment works."



Typical Welding Repair Operations.

(1) *On left a gear is being built up.* (2) *The arc-welder is doing a spotting job.* (3) *On right a chain sprocket is being built up. Normally, with the aid of a template, this job is done on worn sprockets in place in the dewatered tank, dismantling not being necessary.*

Records and Costs

In conclusion, a few words in regard to keeping records of maintenance work and costs will not be amiss. The importance of knowing how, when and what was done on any piece of equipment can determine future action.

Repeated failures of any piece of equipment should not be contended with if possible. Records will also show when future maintenance work can be anticipated.

I realize that not all of the experiences related herein are applicable to everyone interested in sewage plant maintenance. I have, however, attempted to show the importance of careful consideration of all the phases of this work. This is especially true in these times when economical operation and the conservation of all resources are so vital.

Lewis Quigley Passes

The late Lewis A. Quigley (A very recent picture)

Lewis A. Quigley, superintendent of water works and sewage disposal, Fort Worth, Tex., died in a local hospital on October 30th following an operation. He was 54 years old and had completed 17 years of service to Fort Worth since taking over the management of the Water Department in 1925.

During Mr. Quigley's tenure at Fort Worth he saw the daily pumpage of water double and the mileage of mains practically doubled in the extended and strengthened system. Noteworthy and something which gave Mr. Quigley a lot of satisfaction, the unit cost of operating the Fort Worth Water Department and delivering water to the consumer's tap declined year by year. By 1929, after only four years of the new regime of council-manager government and Quigley management of the water utility, the Water Department had become something more than self supporting and has continued so. During the past thirteen years, while the system was being extended to the magnitude previously cited, all improvements to the distribution system have been paid for out of current earnings, while also retiring the bonded debt and paying all operating charges and overhead. The latter included rental paid the city for quarters occupied by the department.

Mr. Quigley was born in St. Louis, Mo., Sept. 7, 1888, took the mechanical engineering course and special courses in water treatment at the University of Missouri and won his degree in 1909. If there is such a thing as being born a water works man, "Lew" Quigley was that, for his father and three uncles were builders and operators of water works plants in the midwest. During his summer vacations "Lew" worked in several of his father's plants, particularly the Sedalia, Mo., plant, which he later managed. After that he became superintendent of the Lawrence, Kan., system, leaving after five years to go to Van Buren, Ark., where he rebuilt the entire water system. From Van Buren he went to Fort Worth in 1925.

"Lew" Quigley literally "lived water works" and took a great deal of pride in having been chosen secretary of the Southwest Water Works Association (now the Southwest Section of AWWA) in 1926, a year after locating in Fort Worth. This position he held continuously during the intervening sixteen years up to his untimely death only a short time after the 1942 annual meeting in Little Rock, Ark. Being "association minded," Mr. Quigley joined the American Water Works Association in 1927 and has been amongst the most consistent attendants of its conventions and annual meetings since. He became a member of the Southwest Water Works Association in 1916. He was a member of the Presbyterian Church, a Mason and an ardent Rotarian. His college fraternity was Beta Theta Pi. As a hobbyist, he built and operated a rather remarkable miniature railroad in his garage at home.

While "Lew" was busy with the mechanics and politics of running annual meetings of the Southwest Section a lovely lady in the person of Mrs. Quigley added charm and grace to the social functions.

Denver's Water Budget Upped $106,663

The Denver Water Board has prepared its new budget for 1943 with $106,663 added to care for extra operating and maintenance costs resulting from the effects of war on the operation of the water supply system of Denver.

The budget will provide $960,766 for maintenance and operation, compared with $854,105 this year, according to George F. Hughes, Secretary of the Board.

Increased revenue will be sufficient to meet the heavier budget without an increase in water rates and the budget does not need approval of the City Council, since the Commission functions as an independent municipal entity.

The largest item in the increase, $71,237, will be used to buy equipment and hire men to guard the water system against sabotage. Increases in the cost of chemicals account for an increase of $27,000 to operate the filtration plant.

J. B. Lippincott Dies in California

Joseph Barlow Lippincott, well known hydraulic engineer of Los Angeles, died suddenly while on an inspection trip to one of the several army projects which he had been supervising. He was 78 years old.

Mr. Lippincott who had gained prominence because of his engineering ability was born in Scranton, Pa. He was graduated from Dickinson College and the University of Kansas. In 1888 he began his professional career on the engineering staff of the Santa Fe Railroad. He then served the U. S. Geological Survey, initiating its hydrographic study of streams and the underground water basins of California. Later he planned a $3,000,000 irrigation system in the Hawaiian Islands and the supply works of the Santa Barbara water system involving a 4 mile diversion tunnel. In 1906 he became Ass't. Chief Engineer on the Owens River Aqueduct supplying the City of Los Angeles and was responsible for the design of this important 250 mile conduit, 5 dams, 60 miles of tunnels and 3 hydro-electric plants.

In 1913 he entered private consulting practice to serve numerous west coast cities in connection with their water systems. At the time of his death he was engaged in engineering construction at Camp Hoan, March Field, Marysville Cantonment, and the basic training center at Salt Lake City.

In 1932 Mr. Lippincott was appointed a member of the International Water Boundary Commission of Mexico and the United States. In 1936 he was elected an Honorary Member of the American Society of Civil Engineers.

Mr. Lippincott is survived by his widow and a son, Lieut. J. R. Lippincott, U. S. Navy who is held prisoner on the Phillipine Islands.

SOUTHWEST SECTION'S WARTIME CONFERENCE

Attracts Record Attendance at Sessions

THE Wartime Conference of the Southwest Section of the American Water Works Association held at Little Rock, Ark., October 12 to 14, closed with 329 active and associate members and guests officially registered. While this, the Thirty-First Annual Meeting of the Southwest Section formed by the states of Arkansas, Louisiana, Oklahoma and Texas, was not of record attendance in numbers it was generally conceded as establishing a record in respect to interest manifested and attendance at the technical sessions.

W. F. McMurry, Superintendent, Tulsa, Okla. (1941-1942)

L. A. Jackson, Superintendent, Little Rock, Ark. (1942-1943)

Meeting headquarters, manufacturers' exhibits, and all technical sessions were at the Marion Hotel. The illustrated lecture and sound picture on "England—Its Civilian Protection and Utility and Industrial Operations in Wartime," by Davis M. DeBard, Vice-President, Stone and Webster Service Corporation, New York, N. Y., was presented in the Joseph T. Robinson Memorial Auditorium Tuesday evening.

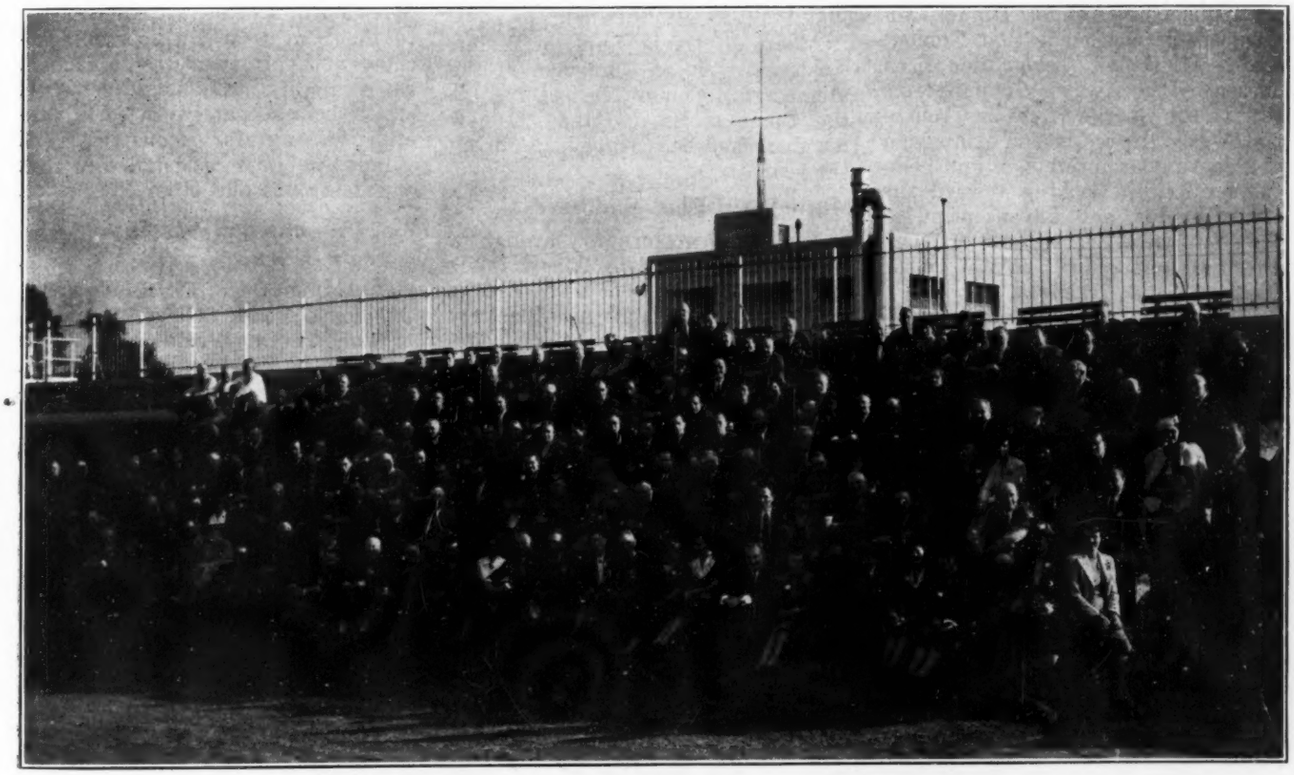
A full schedule of worthwhile papers occupied the three day conference. Even the daily noonday luncheons were utilized in bringing to those in attendance important messages bearing on wartime waterworks problems.

The inspection trip to Little Rock's new filtration plant on Tuesday afternoon was a meeting highlight. Here, following an inspection of this very modern plant, the ladies joined the group on the terrace overlooking the river for the annual convention picture. In the meantime an organization skilled in preparing and serving good food was setting the scenes for the tasty Bar-B-Q buffet supper to follow. The city of Little Rock should indeed be complimented, not only on its excellent modern filtration plant but also on the unusually

The Late Sec'y*
Lewis A. Quigley, Superintendent, Fort Worth, Texas

Nat'l Director
Thos. L. Amiss, Superintendent, Shreveport, La.

*(*Mr. Quigley passed away on October 30th, only two weeks after closing his books for the 16th year as secretary of the Southwest Section)*



A Number of Those Who Enjoyed the Barbecue Served on the Plaza of Little Rock's Hill Top Filtration Plant Overlooking the Roily Arkansas—but "Having None of It" Since the Bringing in of the 35 Mile Distant Soft Trout Waters of the Mountains

picturesque setting as well as technically strategic location chosen for this plant.

Entertainment

For the ladies a tea was arranged for the first day a luncheon and card party the second day. Complimentary theater tickets were available for their use at any time during the meeting. On the opening evening an informal get-together dance was

Made Vice-Pres.
Robt. W. Harding, President, Bexar County Water Co., San Antonio, Tex. (New Vice-Chmn. of the Section)

Honored
Egmont Smith, S. W. Manager, Neptune Meter Co., Dallas, Tex. (Was voted the Fuller Award)

arranged, on the second afternoon the exceptional Barbecue Picnic supper on the Filter Plant Terrace, and the third evening the Annual Dinner Dance ran into the small hours.

Award to Egmont Smith

During the Annual Dinner announcement was made that Egmont Smith of Dallas, Texas, had been chosen by the Awards Committee to receive the George W. Fuller Memorial Award in recognition of his long and continuous interest in and helpful services in looking toward the strengthening and advancement of the Southwest Section and the Operator's Short Schools held in Texas, Oklahoma and Arkansas.

[Mr. Smith, since the sudden passing of Lewis A. Quigley, for 16 years secretary of the Section, has taken on the responsibility of acting as the interim secretary until a permanent appointment of a successor to Mr. Quigley is made.—Ed.]

Officers Chosen

The following nominations were presented by Morris Turner, as Chairman of the Nominating Committee and voted into office unanimously.

Chairman

Leslie A. Jackson, Superintendent Little Rock Water Department.

Vice-Chairman

Robert W. Harding, President, Bexar County Water Co., San Antonio, Texas.

Secretary-Treasurer

Lewis A. Quigley, Superintendent Water Department, Forth Worth, Texas.

Trustees

For Arkansas—M. H. Phillips, Supt., Paragould, Ark.

For Louisiana — B. G. Cole, Chemist, Monroe, La.

For Oklahoma—Frank S. Taylor, Supt. Filtr., Oklahoma City, Okla.

For Texas—Homer A. Hunter, Supt., Dallas, Texas.

Thomas L. Amiss, Supt. of Water and Sewerage, Shreveport, La. (past-chairman of the Section) is A.W.W.A. Director, having been elected in 1941 for the three-year term ending in 1945.

Nice Gain in Membership

Albert H. Davis, Supt. of Water, Austin, Texas, as Chairman of the Membership Committee, reported to the Business Session that 32 new members had been signed up during the year.

Mutual Aid Plan Endorsed

The Southwesterners through a resolution proposed by Albert Davis and unanimously went on record as endorsing the Mutual Aid Plan for Waterworks and expressing a desire that such be made operative in the four states comprising the Section. The resolution requested A.W.W.A. to establish a special committee to develop a suggested pattern for a Mutual Aid Plan which will serve after the war as well as a war measure. The resolution also suggested that the Mutual Aid pattern be accompanied by whatever language a legislative act should include to make the Mutual Aid Plan between muncipally as well as privately owned water utilities legal, and without the barrier of state lines to restrict operation of the plan.

This resolution came about as a result of the earlier description of the Mutual Aid Plan, as it has been developed in the several states, by Linn H. Enslow, Editor of "Water Works & Sewerage," who related the several proven advantages of the

Hosts
(Of the Little Rock Water Department)
W. A. Mayhan, Chemist
C. H. Duttlinger, Asst. Cashier
G. H. Sutton, Supt. of Meters

Mutual Aid scheme, recommended it to the Southwest States and advocated its permanent establishment as a highly valuable scheme of strengthening water service in general, making for economies, and planned neighbor assistance in time of catastrophe and other emergency.

Technical Sessions

(As Reported by Edward R. Stapley, Acting Dean of Engineering, Oklahoma A.&M. College.)

"Construction Problems of Little Rock's New Water Supply, by E. A. Elliot, Burns and McDonnel Engin-

Barbecue on the Plaza

Sorry we fumbled this one. Can only recognize Mrs. Leslie Jackson

Mrs. W. F. McMurry, behind the lemonade barrel President McMurry, "Bill" Pebworth and Mrs. Bill, Larry Lingnor (W. W. & S.), and "Art" Clark (W. & S. Wks. Mfgrs. Assn.)

His nibs, the Mayor of L. R. (hand raised), Chas. E. Moyer and Mrs. Moyer. C. H. Duttlinger follows

A.W.W.A.'s Harry Jordan looking a bit chagrinned when Egmont Smith wants to know where he's going to put it all

From the University of Arkansas to pass on Little Rock Barbecue —Professor Spencer (right), and Hale

eering Company, Kansas City, Mo.

While showing moving pictures taken during the construction of the Alum Fork dam and conduit line to the filtration plant in the city, Mr. Elliot kept up a rapid fire of statistics covering the work.

The Alum Fork earth dam has a length of 2,800 feet, a height of 115 feet, and contains a million and a half cubic yards of material. The 300-foot spillway has a safe discharge capacity of 30,000 second feet. Lake Winona formed by this dam covers slightly over 1,200 acres. Its storage capacity is 14 billion

M. H. Phillips, Superintendent, Water Works, Paragould, Ark.

(New Trustee for Arkansas)

Clinton Inglee, President, Natl. Water Main Cl. Co., New York, N. Y. (Entertainment Chmn. for Mfgrs. Assn.)

gallons and its tributary drainage area 43 square miles. The 85 foot intake tower is provided with draw-offs at four levels.

Great care was exercised in sampling and testing soils throughout the construction of the dam to provide adequate field control. Twenty-five different types of soils were encountered. The entire overburden varying from 18 inches to 18 feet was removed to reduce settlement and replaced by borrowed pit material. Much of this borrowed material contained a large percentage of rock. Material was deposited in 8 inch layers and compacted by 14 passes of tandem sheepsfoot rollers. Compaction was tested by the plasticity needle. Maximum settlement found was 1½ feet in the 115 maximum height.

The 35 mile reinforced Lock-Joint concrete pipe line from the lake to the filter plant has a 39 inch inside diameter and a daily capacity estimated at 25 M.G. Conduit pressures vary from 0 to 300 feet. This required careful identification of pipe sections to combine safety with economy. Vibration was used in getting the low slump concrete out of the buckets and in compacting it in the forms at the pipe plant. The line was tested under 100 per cent excess pressure. Allowable leakage could not exceed 10 per cent. Pressure relief and vacuum valves were installed at appropriate points to prevent excess pressures developing under operating conditions. Chlorination at the lake has been used to control capacity reducing algae biological growths on the pipe line.

[This effectual chlorine treatment with results attained is to be the subject of an article by Messrs. Jackson and Mayhan in an early issue of this magazine.—Ed.]

"Health and the Cycle of Water" a sound motion picture shown through the courtesy of the Cast Iron Pipe Research Association depicted the water problems of the imaginary City of Centerville in 1860, 1890, 1920, and the present, with their solution. Phantom and animated views of modern water and sewage plants were shown. Modern factory tests of cast iron pipe were also pictured.

Taking part in a panel discussion on **"Sanitation Problems of Water Supply Systems Resulting from Defense Activities and Extraordinary Demands for Water Service"** were representatives from the Health Departments of the four states of the Section and the Wallace & Tiernan Co.

Under the heading of **"The Relation Between the Small Public Water Supply and the State Health Department,"** Walter A. Reiman, Chief Engr., Arkansas State Board of Health, stated that water superintendents and plant operators have a common goal with their state health department, and that they should always be able to meet on a common ground. State health department organizations may vary in form from state to state but the results desired are the same. Legal power is best tempered with an appreciation of local difficulties. Public education is essential. He listed as important services of health de-

Wheelhorses

George Rohan, Superintendent, Waco, Texas (Past Chairman and Retiring A.W.W.A. Director)

Albert Davis, Superintendent, Austin, Texas (Past Chairman of the Section)

Fred Puckhaber, S. W. Manager, W. & T. Co., Dallas, Texas (Exhibits and Entertainment Committee)

partments: laboratory testing; public education; training programs; and dissemination of information concerning valuable new developments.

"Cross Connections for Auxiliary Supply" was covered by F. W. MacDonald, Associate Sanitary Engineer, Louisiana State Board of Health. He emphasized the importance of surveys to check existence of possible cross connections. However, the shortage of materials is making continued progress in their elimination more difficult. Double check valves with drips, coupled with frequent inspections, may be allowed as a temporary expedient. The use of canvas tanks and temporary dams for local storage of water in Britain was mentioned in connection with possible emergency use here. No connections with drinking water lines should be allowed. Interval chlorination of such stored supplies will prevent odors.

In a paper on **"Problems Resulting from Plant Expansion and Min-**

More Barbecuers

The Vice-President of the Little Rock Water Board—T. J. Gray and Mrs. Gray, Egmont Smith and Marvin Turner

Marion Cris, Consultant to the Water Board and Mrs. Cris on left; W. H. Williams, Secy.-Treas. of the Board and Mrs. Williams

The Plaza, high above the Arkansas, where the Barbecue was served

Mrs. Fred Puckhaber (left), Mrs. Ted Williamson of Fort Worth, and Hayes Kuhns, who "never misses a bet"

The Little Rock crisis once more

Miss Hattie McLeod, Water Department, Little Rock (Chmn Jackson's Secy. and "right-hand man" during the meeting)

A. B. Cole, Sr., Superintendent, Midland, Texas ("At home on the range"—his ilk made the West)

imum Standards for Water Treatment Plants," H. J. Darcey, Chief Eng., Oklahoma State Health Department, explained that even though war needs had compelled the use of minimum design factors and temporary construction there had been no relaxation in quality of water to be supplied. He emphasized the great need for more men trained in sanitary engineering, stating that the technical schools had not been traning enough men for even ordinary needs. State-wide training programs would prove valuable, and training by each city of its own replacements was suggested. The need for agreement among the various federal agencies on requirements in order to decrease loss of time and money in modifying plans was stressed.

"Main Sterilization, New Installations and Repairs" was covered by C. H. Billings, Chief Assistant Engineer, Texas State Board of Health. Mr. Billings made the analogy between the need of sterilizing mains and the need of pasteuring milk as a safety factor even though the product had been carefully prepared and handled previously.

The following procedures, listed in descending order of preference, were suggested:

1. Liquid chlorine water mixture.
2. Liquid chlorine direct feed.
3. Calcium hypochlorite water mixture.
4. Chlorinated lime water mixture.
5. Calcium hypochlorite in dry state.
6. Chlorinated lime in dry state.

Residual chlorine tests of water at points farthest from point of chlorine introduction give measure of treatment. Residuals of 40 to 50 p.p.m. and contact period of 3 hours should be considered minimum. Since the chlorine does not effectively penetrate into the joints, sterilization of jute and hemp before use is recommended. Even leather seats of fire hydrants have been found contaminated. Sodium thiosulfate, or "hypo", may be used to dispel chlorinous tastes. The importance of care in pipe laying and of training and skill in handling sterilization of new lines and repairs was emphasized. Possible capping of pipe sections by manufacturer was suggested as a post-war possibility.

"Recent Developments in Sterilization Treatment," by A. E. Griffin, Sanitary Engineer, Wallace & Tiernan Co., Newark, N. J.

Mr. Griffin announced that four new outstanding tests for residual chlorine have been developed in the past few years. The time required by any method is important. A test for residual chlorine is wanted and not one for the amount of orthotolodine added. A distinction between the action of chloramines and chlorine is also important. The sodium arsenite and methyl orange methods used for determination of chlorine as against chloramine residuals were mentioned.

The use of "break-point" chlorination has permitted a decrease in alum required, the dropping of prechlorination, and other savings. Results are dependent largely on control. In developing continuous check and control, Laux of Indiana used the fact that residual reappears beyond break-point.

The value of using chlorine in reducing corrosion, reopening clogged deep well screens, and in eliminating slimes and organic accumulations was particularly stressed. Annual tonnage loss of metal due to corrosion was estimated at two per cent. Formerly many untreated natural waters failed to corrode mains over long periods while treated water later proved very corrosive. Mechanical removal of growth from well screens, sands and gravels may be dangerous. Chlorine treatment may be used effectively. Carrying capacity of pipes may be considerably increased by the removal of interior slimes through chlorination, as has been the experience in Little Rock and elsewhere.

Programmers

Professor W. R. Spencer, Dean of Engineering, University of Arkansas, Fayetteville

Carl E. Schwab (Major U.S.P.H.S.), Regional Engr., 8th Civilian Defense Region, San Antonio, Tex.

Frank S. Taylor, Supt. Filtration, Oklahoma City, Okla. (New Trustee for Oklahoma)

"Some Aspects of Filtration Plant Design and Operation," by Edward R. Stapley, Acting Dean of Engineering, Oklahoma A. & M. College, Stillwater, Okla.

The processes of aeration and sedimentation were singled out as two water treatment processes about which there was a very incomplete understanding and lack of appreciation by many operators.

The more important factors effecting the practical efficiency of

"Cy" Bird, Distr. Manager, Pitometer Co., Chicago, and Mrs. Earl Anderson of Shreveport, La., Secy. to Tom Amiss, Supt. of Water and Sewerage

Larry Lingnor of "W.W.&S." (Chicago), the vivacious Marie Schouten (Oklahoma City), and "Brownie" Brown, Chicago Manager, National Water Main Cleaning Co. The fellow who wouldn't be left out is just "Ernie"—Marie's hubby

"Beauty and the Wolves"—Comely Jimmy Lee Jones (Mrs. "Bob" Jones of Fort Worth), with Guy Northrup and Charlie Becker

Ed. Byerley, Manager, West Helena (Ark.) Water Co., Mrs. Byerley and Arthur Shurtleff, Pittsburgh Meter Co., Tulsa, Okla.

Some Historic Buildings in Little Rock

The Old State Capitol dates from the year that Arkansas was admitted to the Union as a state and was so used from 1836 to 1910. It now serves as a War Memorial

This historic building served as the original Territorial Capitol of Arkansas prior to 1836. It has recently been restored, which accounts for its spic and span appearance

General Douglas MacArthur was born in this building—formerly a Civil War Arsenal, later a U. S. Army Post quarters for officers. MacArthur's father was Post Commandant. Is Little Rock proud?

aeration were stated to be area of contact surface between water and air, time of contact, difference in saturation or deficit of gas in water as compared to that in the air, thickness of surface films on water and air, and movement of stirring of water and air. An analogy was drawn between the flow of water through an opening in the wall separating two tanks containing water at different levels and the exchange of gases through the common contact surface between water and air. Numerical values for the time of fall of water drops through varying distances were given as well as the time for bubbles of compressed air to rise through a corresponding distance. These relative contact periods were multiplied by the relative advantage in surface film thinness to get a better method of comparing effectiveness. The advantage from the standpoint of time of contact of broken fall, as in the case of an aerator of the baffle cascade type, over that of a single fall through equal height was shown by numerical values.

The inadequacy of designing sedimentation tanks entirely on the basis of detention period was pointed out. Capen had found many tanks where the actual "flowing through" time was as little as 10 per cent of the theoretical detention period. In none of the many tanks investigated, did Capen find this ratio to be greater than 50 per cent. The use of multiple pipe inlets to tanks was suggested as a method of getting more even initial distribution across the width of the tank. Perforated baffle walls across the tanks near ends instead of simple weirs or plain baffles was advised. The area of openings in these walls should be small enough to give a fair large loss of head through them in order to more evenly distribute the velocities in the tank cross-section. Velocities through these openings should, however, be kept under one foot per second to prevent breaking up of floc.

Light longitudinal guide vanes were suggested as a means of reducing cross or diagonal currents. Similar guides used at the corners would reduce the dead space in around-the-end type settling tanks. If such guides were of a semi-fixed type, some experimental adjustment would be permitted to obtain their proper placement.

The relative settling velocities of a particle in water at 50° F., at 68° F., and 86° F. were given to show that settling tanks should be designed for cold weather conditions and not for summer or even average yearly temperatures. Only about two-thirds the time is required for a particle of 0.1 mm. diameter to settle out at 86° F. as is required at 50° F.

The "surface rating" principle of settling tanks design was explained as a process of skimming off liquid from the surface of the tank only as fast as particles of a selected size would settle out of that layer to the layers beneath.

In discussing this paper *A. H. Ullrich*, Chemical Engineer, Ft. Smith Water Department, Ft. Smith, Ark., outlined the troubles experienced in the settling basins at Ft. Smith. Strong currents at inlets and unequal velocities across the tank are noticeable. Winds blowing lengthwise of basins, and at times reversing completely in direction provide problems not yet solved.

"The Disposal of Trinitrotoluene (TNT) Waste Waters and Its Relation to Public Water Supplies," by Paul Hansen, Consulting Engineer, Greeley and Hansen, Chicago, Ill.

Such wastes are relatively harmless as compared to sewage according to Mr. Hansen. Their objectionable features come entirely from the taste and color which these wastes impart. Tastes are acid or medicinal and not necessarily obnoxious. Red waste water produces noticeable color in dilutions of 1 in 20,000. A dilution of 1 in 2,000 has been found to increase the color 90 ppm. A dilution of 1 in 3,000 increases the color about 60 ppm. A color of 75 ppm. may not be considered unreasonable.

Activated carbon is effective in removing color from TNT wastes but the method is very expensive. Alum is effective at much lower cost.

Earl Benedict, Filtration Engineer, Wichita Falls, Texas and Mrs. Benedict

A. B. Cole, Sr., Supt. of Water, Midland, Texas and Mrs. Cole

A. P. (Bobbie) Jones (left), Consolidated Chemical Co., Fort Worth, Texas Ernie Schouten, Distr. Manager, W.&T. Co., Oklahoma City Mrs. Schouten (left) and Mrs. Jones (right)

Jas. R. ("Brownie") Brown, Natl. Water Main Cleaning Co., Chicago and Mrs. Thos. L. Amiss, Shreveport, La. (Putting on a little act)

B. G. Cole, Chemist, Water Dept., Monroe, La. (New Trustee for Louisana) and Mrs. Cole (She just loves a convention)

P. G. Price, A. P. Smith Mfg. Co., Chicago and Miss Hattie McLeod, Little Rock Water Dept.

Leslie A. Jackson, Supt., Water Dept., Little Rock, Ark. (The new Chairman) and Mrs. Jackson

Mrs. Lewis A. Quigley (Fort Worth) and Mrs. Egmont Smith (Dallas) (Resting some tired tootsies)

Fred H. Puckhaber, Southwest Manager, Wallace & Tiernan Co., Dallas, Texas and Mrs. Puckhaber

W. E. (Bill) Pebworth, Southwest Manager, Hersey Meters, Dallas and Mrs. Pebworth

Economy indicates a bleaching treatment of red wastes at the plant with chlorine prior to dilution. Adding yellow wastes to the red wastes reduces the latter to the acid side. Two tons of chlorine are needed per day at the average plant. Quick lime and milk of lime are used to neutralize the wastes. Evaporation and incineration of residue have been found very expensive.

"The Pollution of Public Water Supplies by the Use of Chemicals and Bacterial Cultures," by Lt. Harry E. Barnes, M.C., Camp Joseph T. Robinson, Little Rock, Ark.

The use of poisons is a very old weapon, said Lt. Barnes, and its possible use by an enemy must always be guarded against. Throwing bodies of men and animals into rivers and wells has been a common practice of a retreating enemy. The chief fear now is with regard to possible contamination of public water supplies. Actually, danger to these supplies from explosions and the sabotaging of weak spots of systems is of greater importance.

Open bodies of water may be contaminated by gases, smokes and incendiaries. The dilution and self-purification characteristics of water are of great value in reducing danger. Heavy metal poisons are slowly absorbed by the body. Arsenite and cyanide compounds are of high importance. Strengths of 1 to 5 ppm. may be considered toxic.

Bacterial contamination would be ineffective in reservoirs where filtration and chlorination are practiced. Ordinary chlorine residuals would not, however, be effective against further contamination following treatment.

Suggestions by Lt. Barnes for use if the necessity arises are as follows. Obtain heavy floc; use of 500 lbs. or more of activated carbon per million gallons treated; filtration at a maximum rate of 1½ gallons per square foot per minute; and chlorination to desired residual.

In discussing this paper it was suggested that graphing of pH and chlorine residuals was a valuable aid in calling attention of operator to deviations which might possibly be due to contamination.

"The Detection of Poisons in Water Supplies," by Dr. O. M. Smith, Dept. of Chemistry, Oklahoma A. & M. College, Stillwater, Oklahoma.

If ordinary water use were assumed, from one-half to one ton of white arsenic, would be needed per M.G. of water to produce dangerous conditions, according to Dr. Smith. Assuming water to contain 10 ppm. of poison and accepted information concerning amounts of poisons necessary for a fatal dose, the following calculations were made:

Poison	Safe Quantity to Drinks Daily, Gals.	Quantity Needed to Be Fatal for an Adult, Gals.
Arsenic	1-13 to 1-8	2.5 to 8
Mercury	1-10 to 1-3	2 to 8
Lead	1-20	300
Fluorine	Over 2	25 to 100
Cyanide	1-13 to 1-8	1 to 2.5
Strychnine	1-13 to 1-4	1.5 to 3
Nicotine	½ to 3	1 to 4

Methods of detection should be reasonably rapid. The materials and equipment needed should be such as are readily available.

Precipitation by hydrogen sulfide after acidification with hydrochloric acid gives a simple test for presence of arsenic and lead. A noticeable precipitate will be formed if lead is present down to values of 2 ppm. In this test a 100 ml. sample is taken, 1 ml. of HCl is added, followed by 10 ml. of H_2S.

A sheet of copper, cleaned with acid until bright, when placed in a solution will indicate by coloring the presence of arsenic and by amount of this color the strength of the poison. For mercury this same test is usable but with less sensitivity.

The presence of cyanide may be detected by holding a filter paper soaked in picric acid just above the liquid. If cyanide is present the paper will turn a brick red color.

Reports from several cities indicate the following steps are being taken to safeguard public water supply: At Dallas only routine tests are being made but at 2-hour intervals. At Houston the spectograph is being used.

Berkeley and Los Angeles, California are making routine tests for common poisons. Gold fish are being maintained at some plants to indicate toxicity. It is believed impossible to raise lethal amounts of disease bacteria.

In discussing the papers by Lt. Barnes and Dr. Smith, Dr. Harrison Hale, head of the Department of Chemistry, University of Arkansas, suggested extreme alertness to unusual conditions as shown by the regular routine plant tests. Advis-

Percy Daniels, Supt., Water and Sewerage, Weleetka, Okla. Ernest Schouten, Distr. Mgr., Wallace & Tiernan Co., Oklahoma City

Bert Sprangel, Supt. Water and Sewerage, Claremore, Okla. V. E. Stockton. Supt. Water and Sewerage, Stillwater, Okla.

Al. Davis, Supt., Water and Sewerage Treatment, Austin, Tex. Buck Foster, Supt., Water and Sewerage, Broken Bow, Tex.

Barney Brown, Supt., Water and Sewerage, Hot Springs, Ark. Chas. Barry, Badger Meter Co. (A charter member. Has attended 30 of 31 meetings since)

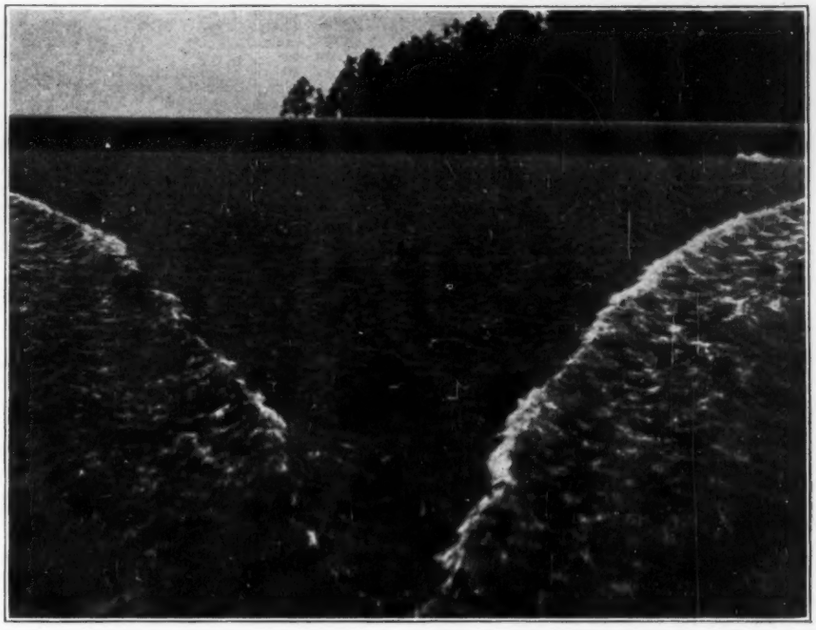
Jas. V. Donley, Pittsburgh, Des Moines Steel, Dallas and C. W. Beatty, Vogt Mfg. Co., Louisville, Ky.

ing the citizens that the water authorities were on the alert for possible dangers would increase the steadiness of the public.

Dr. Hale suggested that compounds like phenol if present in only 1 part in 500,000,000 parts give a noticeable taste when chlorinated.

In discussing the effect of chlorine on gold fish, opinion seemed to vary. One individual claimed that 0.5 ppm. chlorine residual would not kill gold fish, while another stated that 0.5 ppm. of chloramine residual would do so. It was pointed out that causticity will also kill the fish.

In a "Priorities Clinic" conducted by Mr. C. S. Christian, District Manager, War Production Board, Little Rock, Ark., many questions and answers occupied the 45 minute period allotted. All present received some enlightening information. Due, however, to the continuing changes in such information no abstracts are being included.



Little Rock's Unique "V" for Victory

This interesting white water formation takes place on Little Rock's spillway at Lake Winona

Selective Service and Deferment Procedure

"Selective Service of Essential Public Water Supply Operator and Deferment Procedure," by General E. L. Compere, (U.S.A. Retired) State Director of Selective Service, Little Rock, Ark.

Public water supplies stand next to war industry in importance according to General Compere. While primary purpose of the Selective Service Act is to obtain men for the armed services, its purpose is also to retain essential men for war industry and home activity. Great pressure is frequently put on Local Boards to put men in the army who would be much more valuable at home. It is just as essential to serve in industry and in necessary civilian services as in the army if we are to win the war.

Classification of all registrants is made on the basis of written material submitted to the Local Board and found in the registrant's personal file.

In considering occupational deferment the following questions are asked:

1. Is it an essential activity to winning the war and would its discontinuance be a serious handicap.

2. Is registrant's job or position a critical one, requiring a man with a certain degree of special training. There may be seasonal breaks in the occupation, however.

3. Is there an adequate supply or is there a shortage of such workers. Do not draw conclusions from local knowledge but get in touch with U. S. Employment Service. Its many branches have as their work the finding of men for jobs and jobs for men.

The time period of deferment for occupational reasons will depend on time needed to train a replacement. Employer is expected to start training a replacement at once to show good faith. The maximum deferment period is ordinarily 6 months. There is no such thing as deferment for the duration. Men in positions requiring long training, such as engineers and chemists may be again deferred. For replacements, men over 45, or those physically incapacitated, or women should be sought.

Form 42A should be filed with the Local Draft Board by every employer on every man he wants to have deferred. Job should be fully described to make clear its nature to the Board. This form should be filed preferably before registrant has been classified in 1-A. It must not be considered as unpatriotic to file form 42A. Public water supply systems, above all, *must* be kept going, emphasized the General.

After classification, if Form 42A has been filed by the employer, the Local Board sends Form 57 if registrant has been given deferred classification as requested. If placed in 1-A by Board, Form 59 is sent. If Form 42A has been unfavorably acted upon the employer has the same right to appeal as has the registrant, who may not wish to appeal

E. L. Filby, Black & Veatch, Engrs., Kansas City

A. H. Ullrich, Purification Engr., Fort Smith, Ark. The Chairmen,

W. F. McMurry, Supt., Tulsa, Okla. and L. A. Jackson Supt., Little Rock

Otto F. Knopf, Johns-Manville Co., Shreveport, La.

R. E. Wages, Supt., Water and Sewerage, Springdale, Ark.

Major John C. Pritchard, Area Engineer, Adams Field, L. R.

Hayes Kuhns, The Leadite Co., Kilbuck, Ohio

M. H. Phillips, Supt. of Water Paragould, Ark.

Norman H. Abrams, Badger Meters, Waco, Texas

(1) (2) (3) (4) (5)

(1)—*Eugene J. Bender, Commissioner, E. Jefferson Parrish Water Wks., New Orleans*
(2)—*Jas. D. Fowler, Consulting Engr., Dallas, Texas*
(3)—*G. T. Lepley, Southwest Mgr., Darling Valves, Dallas, Texas*
(4)—*Wm. T. (Bill) Birch, President, Birch Mfg. Co., Chicago*
(5)—*Harrell Roberts, Supt., Water and Sewerage, Camp Robinson, Little Rock*

for fear of being called a slacker. A 10-day period is allowed for the appeal. If the 10-day appeal period has been passed the Local Board may still grant permission to make the appeal.

In an "Open Forum" following, conducted by Commander E. L. Olds, Occupational Advisor, Little Rock, Ark., it was brought out that for a registrant employed in an essential occupation, and deferred on that account, it would be necessary for him to get a release on Form DSS 190 from his Local Board before he can enlist. Also, if classified in II-A II-B, or III-B, the Local Board must give release before registrant can enlist. If a registrant given occupational deferment then quits his job, the Local Board should be immediately notified that he left, with prejudice.

Under **"Pensions for Water Works Men,"** William W. Brush, Editor of Water Works Engineering, New York, N. Y., gave some interesting information at the Wednesday noon luncheon.

According to statistics one-third of persons over 65 in U.S. are dependent on others, in part at least, for their support. Saving by an individual in sufficient amounts and safely is difficult. Personal saving is more painless if part of salary is retained.

Employees of private companies come under the Social Security Act and systems set up by many of those companies. Under this Act pension retirement payments were provided for those over 65. It did not include the employees of state or other political subdivisions.

Mr. Brush gave the chief reasons for pensions for municipal employees as being that their pay was usually lower than for corresponding private employment and that employees old in the service of a city should not be discharged due to incapacity of age. He advised that all pension plans should be based on actuarial figures to be financially sound. Compulsory participation by employees was also advised, with contributions by both employee and the community. Administrative expense of a pension plan should be borne by the city.

Seven states now have a statewide pension plan—New York, New Jersey, Ohio, California, North Carolina, Illinois and Minnesota. All except Minnesota provide that municipal governments make payments to state retirement system or else set up their own employee pension plan. New York is the only state to include all employees down to and including unskilled laborers. New York City has its own pension plan.

Tenure of office, or civil service, is a prime essential if pension plans are to succeed. Twenty states now have civil service. Eleven cities, or 77 per cent of those over 500,000, and 94 cities over 100,000 have adopted it. The percentage goes down as the population decreases with the figure about 11 per cent for cities under 25,000 and the overall average about 18 per cent.

Receipts of 43 states collecting pensions in 1938 ranged from 25 cents per capita for over one-half to a maximum of $6 per capita in various cities.

Municipal pension systems were originally started for police and firemen as those occupations were deemed more hazardous. They are now being extended to cover all city employees. Formerly, pension systems did not constitute a contractual agreement, now they usually do.

In concluding, Mr. Brush advised that all water works men aid in the passage of an amendment to the Federal Social Security Act to cover public employees. Under such an arrangement, he said, the participation of the Federal Government would be greater.

"Distribution System Economies Under Wartime Operation," by W. R. Spencer, Professor of Engineering, University of Arkansas, Fayetteville, Ark.

Professor Spencer, in using as his theme "Save, Stretch and Share," adopted as A. W. W. A.'s slogan, directed attention to the current need for complete information as to sizes and capacities of mains, valve locations, leakage curtailment, "stretching" main capacities by cleaning and precluding the necessity for large mains for the duration. He directed attention to the value of providing elevated storage —now practically unobtainable and requiring greater pump loadings and increased costs to attain the same end. He advocated accurate mapping of the system and the keeping of ample and dependable records. Also that a hydrant flow survey be made for evaluating available pressures and volumes obtainable at various points on the system and revealing condition of the mains. There never was a time when leakage and water loss surveys, hydrant flow tests and main cleaning had been of the same importance as today, stressed the Professor.

In the scheduled discussion of Professor Spencer's paper, A. S. Hatch, Engr. of Distribution, Houston Water Department, said that he could endorse everything in the Professor's paper and had nothing of importance to add.

(1) (2) (3) (4) (5)

(1)—*W. A. Helbig, Darco Corp., New York*
(2)—*Percy Daniels, Supt., Water and Sewerage, Weleetka, Okla.*
(3)—*A. S. Hatch, Distribution Engineer, Houston, Texas*
(4)—*R. E. Wages, Supt., Water and Sewerage, Springdale, Ark.*
(5)—*Wesley Westmoreland, McWane C. I. Pipe Co., Dallas, Texas*

Shots Taken During the Inspection Trip to the Filter Plant and the Lake Winona Chlorinating Station

In the center is a group en route to the plant by trolleys. On the extreme right is the Lake Winona Chlorinating Station, where "break-point" chlorination is practiced and controlled by short-wave radioed instructions from the 35-mile distant filter plant. This station is guarded 1,440 minutes each day by mountaineer marksmen who rank with another mountaineer—Sgt. Alvin York. Arrow points to guard with his deadly long barreled "shootin-rifle"—well known in the country "thar abouts." Note the spot-light equipped guard house atop the important valve control and chlorination house strongly fenced in. With the flick of a switch the fence is lighted all around

Wartime Administrative Problems

"Some Administrative Problems in Water Works Operation in Wartime," by Homer A. Hunter, Supt. of Water and Sewerage, Dallas, Tex.

Mr. Hunter, unable to attend the meeting, sent in his paper, which was read by Albert Davis of Austin, Tex. Mr. Hunter stated that employes leaving to enter the armed services of the nation were considered as merely on leave. Temporary employes, aside from being difficult to find, were inefficient, thus requiring a division of work amongst the regular employes. The department is seeking older men (over 40) as replacement personnel, and is employing women wherever possible, just recently having placed women chemists in the water and sewage laboratories.

Mr. Hunter revealed that Dallas has gone to meter reading every alternate month only. The two month readings are divided by two and one bill filled out for each month. This scheme has saved the need for 17 employes and much material.

Mr. Hunter stated that Dallas had felt the loss of men most keenly in the pumping stations, and finding qualified replacements very difficult, it began to look as if 12-hour shifts will have to be resorted to.

Concerning salaries and wages, Dallas Water Department has recently put into effect a 7½ per cent increase throughout the Department. Labor has been put on a monthly basis, which is apparently well liked by everyone.

As to defense preparations, Mr. Hunter said that they were following a middle-of-the-road policy but had arranged for distribution of materials and men over the system. When it came to maintaining guards, it was a matter of be damned if you do and be damned if you don't.

The number of reports required filed with the Government had reached an amazing number requiring the full time of one man and half time of another to keep abreast.

Texans and Tenderfoot

L. E. Livingston, Mfgrs. Agent, Dallas, Tex. (Atlas Mineral Products, Simplex Valve & Meter, etc.)

Wm. E. Pebworth, S. W. Manager, Hersey Meter Co., Dallas

Arthur Clark, Secy.-Manager, Water and Sewage Wks. Mfgrs. Assn., New York (The hat didn't come from New York)

"Civil Protection in Oklahoma City" was the subject of a paper scheduled for presentation by M. B. Cunningham, Supt. of Water and Sewerage, Oklahoma City. The paper, which was read in parts by Frank S. Taylor, Supt. of Filtration, Oklahoma City, described the Oklahoma City plan which has functioned successfully in both flood and tornado disasters. The details of the scheme are not being released for publication.

"Utility Operation and Civilian Protection" was the subject of talks by Major G. E. McCallum, Asst. Chief Sanitary Engineer, O. C. D., Washington, D. C., and Major Carl E. Schwab, Regional Engr., 8th Civilian Defense Region, O. C. D., San Antonio, Tex.

In these talks the importance of the water utility was stressed and likewise the importance of water supply heads working with and through the local Defense Councils. It is realized that much hard work training and planning is required to keep water systems functioning, but water works men must expect to work harder under wartime conditions without much in the way of commendation.

Both speakers stressed the fact that wearing a uniform might seem more glamorous but that armed service would be impossible without water supply and nothing supersedes the importance of keeping water flowing at home and the community strong and well.

W. P. (Bill) Bowdry, Dallas Foundry Co., Dallas

Harry Hilton, Supt. of Water, Cordell, Okla.

Otto Reynolds, The Leadite Co., Kansas City

(Holding Seegar) and "friends" (—but which)

G. W. Paulette, Utilities Supt., Ark. Ordnance Plant,

Jacksonville, Ark. Nezen Lorio, Operator, Merrero, La.

Ed. E. Feitel, Supt. of Water, Harvey, La.

P. G. Price, "Bill" Birch Harry Jordan (aft view)

M. D. Warren, Supt. Water and Sewerage Hughes, Ark.

A. B. Cole, Sr., Supt. Water and Sewerage Midland, Tex.

WARTIME CONFERENCE OF THE SEWAGE WORKS FEDERATION

Proved Wisdom of Planning Cleveland Meeting, Attended by Better than Four Hundred

THE two-year young Federation of Sewage Works Associations met in Cleveland, Ohio, October 22, 23 and 24, to do a seasoned job of holding its third meeting, planned as specifically a Wartime Conference and patterned after the highly successful Wartime Conference held last spring by the American Water Works Association in Chicago. In conjunction with the national parent organization, the Ohio Conference on Sewage Treatment held its 16th annual meeting.

New President
Geo. J. Schroepfer, Chief Engineer, Twin Cities Sanitary Distr. (Serving W.P.B.)

Honored Guest
J. V. N. Dorr, President, The Dorr Co., New York (A Pioneer)

The success of the Cleveland meeting and its worthwhileness is not to be judged by the official count of 408 registrants as compared to the counts of 555 at the first (Chicago) organization meeting or the second held last year in New York City with 569 paid registrations. The technical sessions in Cleveland proved to be the best attended of the three meetings and, for reasons to become apparent, as this report progresses. Apparently all were present to learn what effects the impact of total war was having on sewage disposal and sewage works maintenance and operation—what the future held in this direction as a probability, how far the Federal authorities would be expected to go in assuring supplies, equipment and manpower requisite in sewage treatment, etc.

As to exhibits of equipment and materials, 34 booth spaces were occupied by 27 exhibitors, which was something of a surprise in these times of priorities and allocation.

On the last day of the meeting the Federation Board of Control voted to plan a similar Conference for 1943, to be held in Chicago, October 14-15-16. Thus was the worthwhileness of the Cleveland Conference signalized.

Rawn Keynoter

A. M. Rawn, Chief Engineer and General Manager, Los Angeles County (Calif.) Sanitation District, later elected as the new Vice-President of the Federation, delivered the keynote address which opened the Conference.

In his review of **"The Influences of This War Upon Sewerage Problems,"** Mr. Rawn directed attention to the steady flow of men and materials to the Army and its allied industries, then stated that the transition from complete freedom of action to present restraint has developed over a period of nearly three years and is now accelerating at a rate which two years hence, he predicted, will make present restrictions in civilian activities seem like a picnic. He then traced the series of events from the spring of 1940, when Congress first appropriated three billion dollars for defense purposes and authorized an army of 400,000 men, to the present stupendous effort —an army of 3,600,000 already in the field or in training, while in contemplation is a military force of 7,500,000, plus the Navy, and an anticipated thirty million defense workers by the end of 1943. This Rawn detailed in order to permit the plotting of a "Curve of Happenings" which extrapolated would permit some predictions for the future.

New Vice-Pres. and Retiring President
A. M. Rawn, Genl. Mgr. and Chief Engr., Los Angeles County Sanitation Districts*

A. S. Bedell, Chief of Bureau, N. Y. State Department of Health
*(*Associate Editor, WATER WORKS & SEWERAGE)*

As of the late summer and early fall months of 1942, Rawn stated that the sewerage authorities were confronted with, among others, the following circumstances:

a. Limited construction materials.

b. Drastic restrictions upon sewerage extensions.

c. Curtailment of all types of equipment.

d. Shortage of manpower.

e. Inability to meet competitive salary offers.

Convention Chm'n
Wm. L. Havens, President, Havens & Emerson, Cleveland

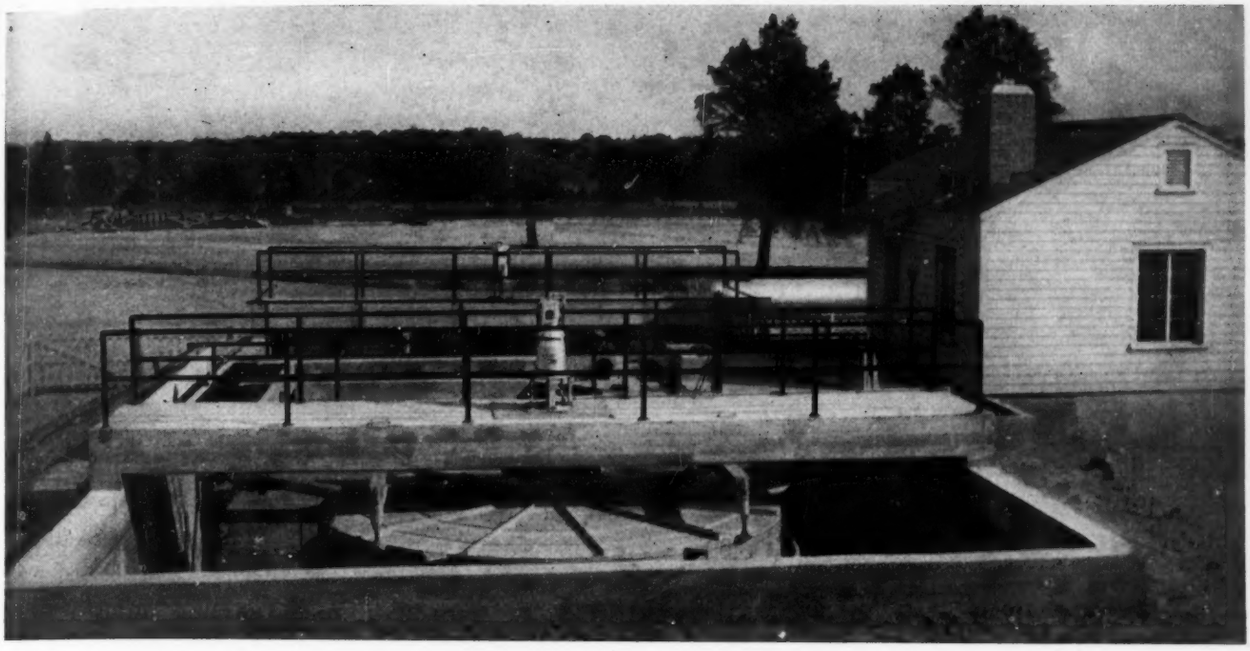
Finance Director
Wm. J. Orchard, General Manager, Wallace & Tiernan, Newark, N. J.

f. Greater complexities in sewage characteristics.

g. Time taken in training for civilian defense activities.

h. Comparative certainty that public health requirements and not mere nuisances would be the criteria for sewerage works operation and extensions for the duration.

Mr. Rawn stated that he did not believe public health was in danger nor that it would be; that he assumed the U. S. P. H. S. was competent to guard against any such likelihood. He then predicted for 1943 and the remaining war years that nothing further would be subtracted from the sewerage cause excepting manpower, and suggested the use of men not likely to be called into the services and female workers as substitutes. He stated that following the war, as his belief, a period of three or four years would elapse during which the adjustment to peacetime pursuits would permit the building of deferred public works and recommended preparation of planning therefor, but that following this first period there would be an



Typical "Chicago" War-Time Sewage Plant with Combination Aerator-Clarifier for 3,000 Population.

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"Chicago" Equipment at 1,000 War Projects
"Chicago" Sewage and Waste Treatment at 115 War Projects

WOODEN "PACKAGE" PLANTS for complete treatment. Purification up to 98 per cent with Combination Aerator-Clarifier for flows to 0.3 M.G.D.

MODIFIED AERATION TYPE plants provide purification up to 85 per cent for flows from 0.10 M.G.D. up.

Simpler design, less construction materials, least mechanical equipment and less time and labor for installation, contrasted to any conventional sewage treatment process.

SWING DIFFUSER Activated Sludge plants for maximum economy in equipment and materials. Purification up to 98 per cent for flows from 0.20 M.G.D. up.

LAUNDRY WASTE PLANTS with Swing Diffusers for treating laundry water. Used at over 70 Army projects.

ORDNANCE WASTE PLANTS with Swing Diffusers for removal of greases and oils from waste water and for acid neutralization.

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•

NON-CRITICAL MATERIALS

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LESS SHIPPING SPACE

•

SHORTER TIME FOR INSTALLATION

•

LESS LABOR FOR INSTALLATION

•

MODIFIED AERATION TYPE TREATMENT

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REPRESENTATIVES THROUGHOUT THE UNITED STATES AND FOREIGN COUNTRIES

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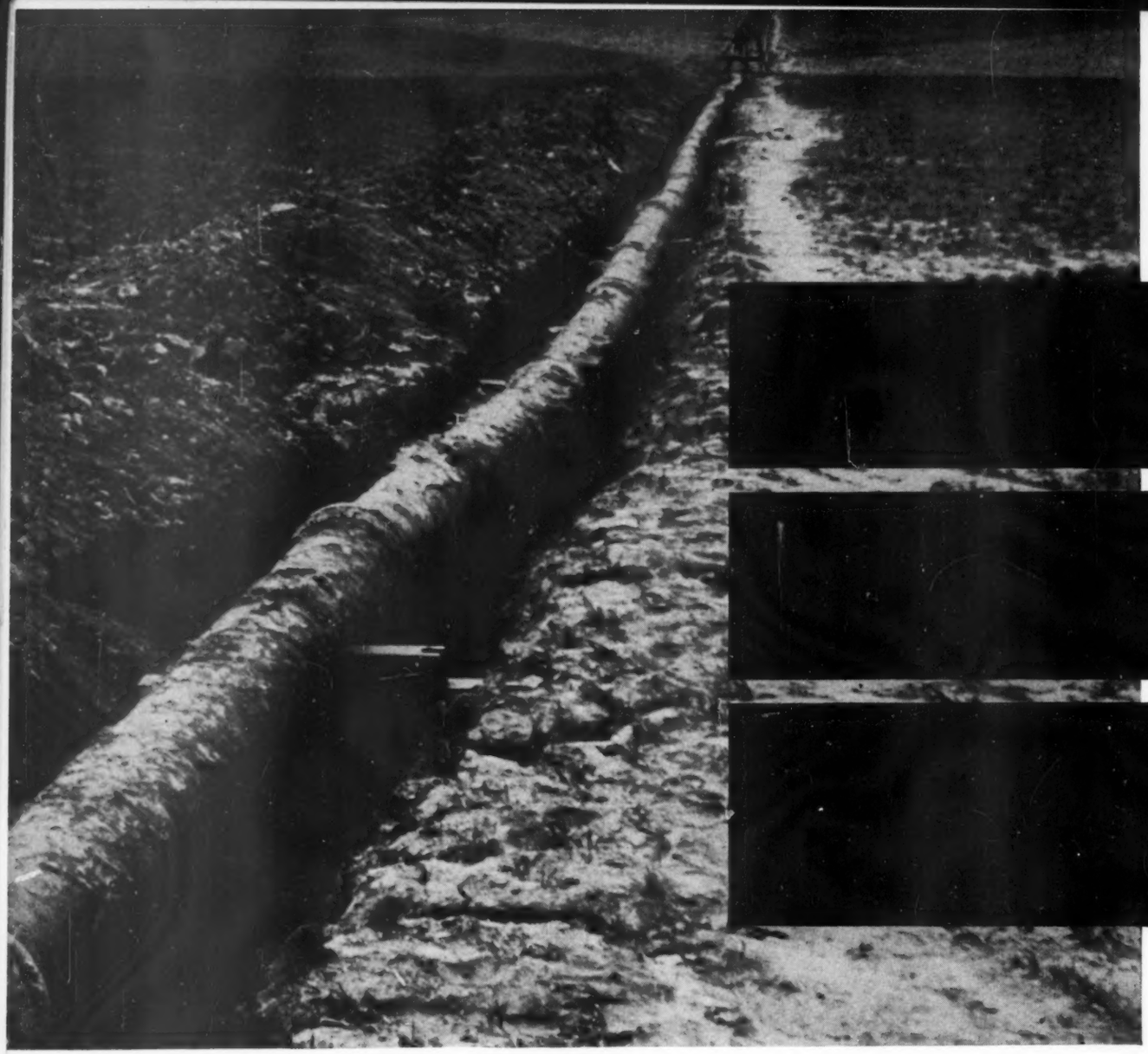

TO INCREASE the supply of water required by a nearby war plant, as well as the growing needs of the community, Hellertown, Pa., had to replace about a mile of 10″ cast iron pipe with a 16″ cast iron line. The old line, after 44 years of satisfactory service, was found to be sound and serviceable, and was re-laid elsewhere to serve out its century or more of useful life.

It is impossible to foretell future requirements or population shifts but any public official can be sure that, when water or sewer mains must be abandoned, re-routed or enlarged, the pipe can be salvaged or reused, if it is cast iron pipe.

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Available in diameters from 1¼ to 84 inches.

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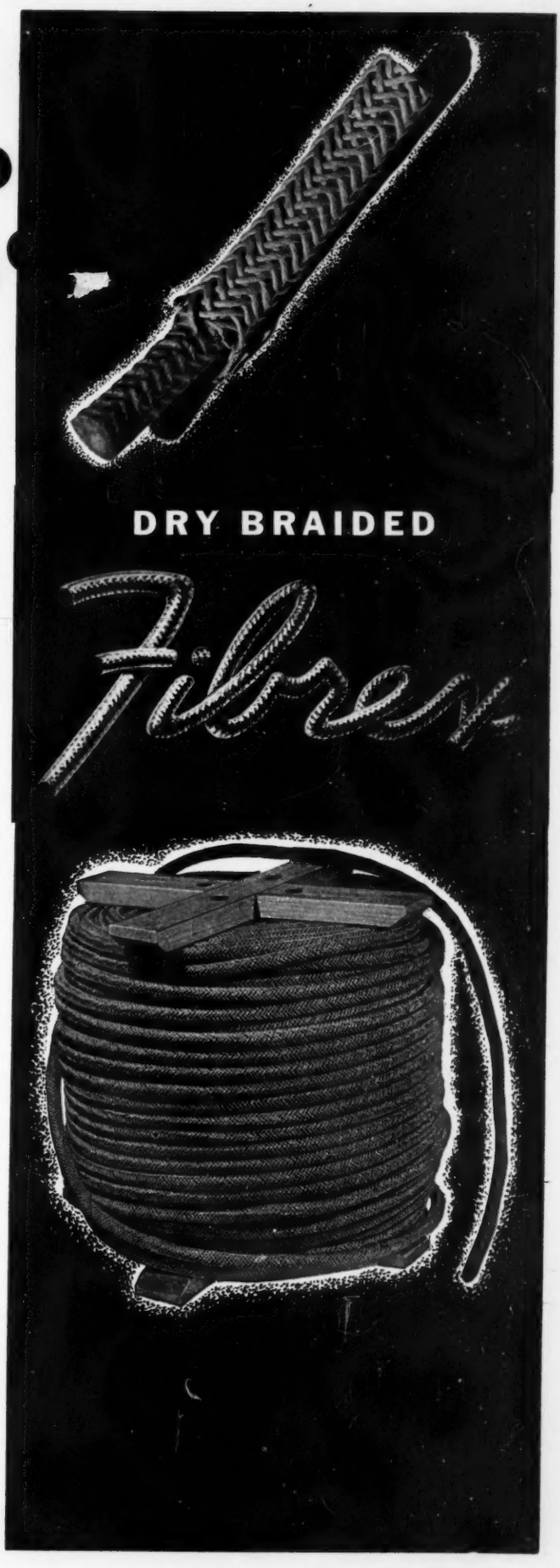

A *Sanitary* Packing—Used in Jointing Bell and Spigot Pipe for Water, Sewer Mains and Soil Pipe.

USED LIKE BRAIDED JUTE WILL NOT BREED BACTERIA

FIBREX is a paper packing treated with a special water repellent which keeps it sterile and prevents its disintegration. It has a hard twisted core with a basket weave covering. Fibrex packs in a joint exactly the same as braided jute.

FIBREX is put up in 35 and 60 pound reels. It is priced slightly higher than braided jute but is much less expensive as 70 pounds of Fibrex will go as far as 100 pounds of jute.

FIBREX is being used with Hydro-Tite and other self-caulking compounds, with lead, Sani-Tite and other asphalt sewer joint compounds. Thousands of pounds of Fibrex are in service in both water and sewer joints throughout the country.

See page 81 for the complete story on Hydro-Tite—the dependable self-caulking compound.

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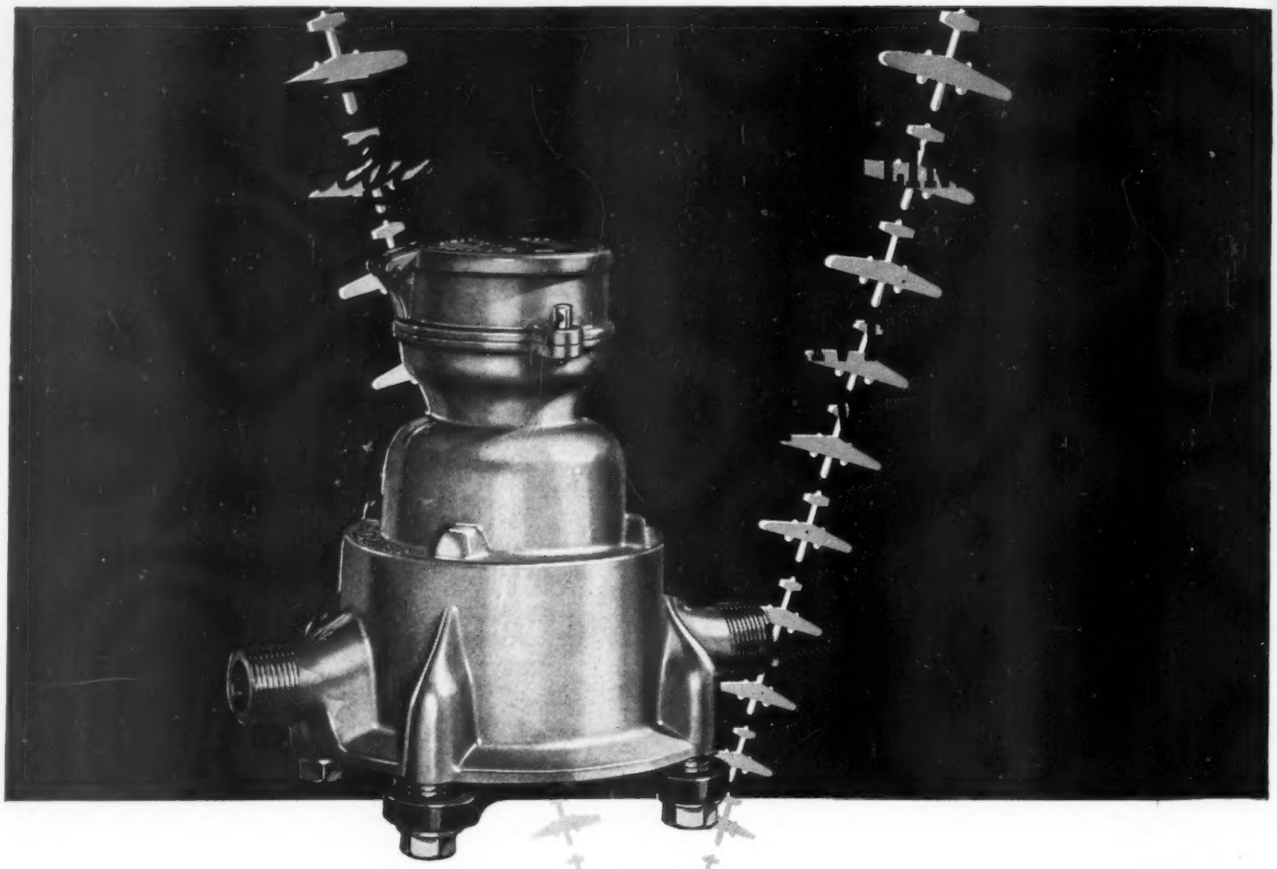

When Uncle Sam said, "Bronze can no longer be spared for water meter housings, because it's a critical material needed for Victory production," Badger was ready with the "Mars" line of water meters. Made with tough, durable, cast iron housing thoroughly protected from rust and corrosion. Its bronze mechanism incorporates the same principles that have made Badger outstanding for accuracy, dependability and sensitivity for over 37 years. By a careful combination of metals in mechanical parts, the "Mars" line of meters saves the maximum amount of bronze and loses none of its durability.

Badger's 37-years experience in manufacturing dependable, accurate, sensitive, durable water meters is drawn upon in the design of the "Mars" line of meters. It deserves your confidence.

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KEEP 'EM SERVING AND SAVING

Conservation of water meters is a patriotic duty. Careful maintenance and repair will reward you with extra years of accurate, dependable operation.

extensive period of prosperity during which public works could be built only at great cost.

Thus did Mr. Rawn indicate the wisdom and economy of planned readiness by municipalities to strengthen its public works structures promptly upon the orders to "cease firing" in this war of wars, or else pay the price of delay later or do without for a number of years.

A Pioneer Honored at Luncheon

On the second day a pioneer in American industry and the mechanization of sewage treatment was honored by being chosen as the speaker at a special luncheon. This pioneer was John Van Nostrand Dorr (D.Sc.), founder and owner of the now far reported Dorr Co., first in the fields of mining and metallurgy, and more recently in those of water and sewage treatment, which the interests of public health and decency had advanced far since Dr. Dorr's attraction to them as offering a never diminishing source of "raw materials" on which to work.

Federation's Trinity
W. W. DeBerard, City Engineer, Chicago (Treasurer)

W. H. Wisely, Supt. Sanitary Distr., Urbana, Ill. (Executive Secretary)

F. W. Mohlman, Chief Chemist, Chicago Sanitary Dist. (Journal Editor)

From President Bedell's introduction we learned that this practical and successful scientist was graduated by Rutgers University as a chemist in 1894 and trained in the laboratories of Edison before being attracted to the mining field, in which methods of separation and classification proved subject to marked improvement and spelled the beginning of Dorr methods and equipment which won for him his niche amongst other famed "Pioneers of America."

Ohio Conference Officers
A. H. Niles, Supt. Treatment, Toledo (President)

W. D. Sheets, San. Engr., Worthington, O. (Secretary-Treasurer)

With this introduction, Dr. Dorr briefly sketched his early contacts with the mining industry and his development of continuous removal mechanisms for the thickened classified mine concentrates. He then revealed that his opportunity to apply to sewerage practice certain improvements which he had developed in the mining field came through a contact with Langdon Pearse at an A. P. H. A. meeting in Colorado Springs in 1913, at which time Mr. Pearse expressed a hope that he (Dorr) would undertake to apply the continuous removal mechanism principal to the subsidence phenomenon in the sedimentation of sewage. It was, however, 1920 before the first completed installation of a Dorr sludge removal mechanism was placed in a sedimentation tank in Florida, for in the beginning the municipal field did not have the same appeal, nor the same status, that it has since developed as a sound business field.

In fact, Dr. Dorr remarked that he entered the manufacture of sewerage mechanisms with some trepidation, because he had been warned by friends that in doing so it would be necessary for his organization to work through municipal officers with all of the accompaniment of political intrigue which is usually present in such transactions. But he could happily state that there had been no involvements to date and that his relationship with municipalities and their officers had been on a high business plane throughout all of his dealings.

Dr. Dorr said that from the early method of water carriage of sewage and disposal in adjacent streams or the sea, the sewerage art had progressed through different periods of recent history from hand methods to modern activated-sludge and other highly mechanized types of sewage disposal, and that his company came into the picture when it became desirable to provide something better than intermittent manual cleaning of subsidence tanks. While he had thought at first that sewerage interests would be a sideline with his company, he had long since found that they had become a very dominant factor.

In closing, he remarked that he had observed that the development of *his* or any other sewerage improvements was in truth a product of the combined efforts of the plant operator, the engineer and the manufacturer, and that credit for such should rightly be shared by all.

Cleveland Hosts
John J. Wirtz, Supt. Easterly Treatment Works (Vice-Chairman Convention Management Committee)

Frank W. Jones, Chief Chemist, Havens and Emerson Engrs. (Registrar—Quarter Century Operator's Club)

Walter E. Gerdel, Supt. Westerly Treatment Works

Proving that Dr. Dorr's profession of a high interest in sewage treatment was genuine, he remained for the full meeting and put in Saturday afternoon with the sizable group inspecting Cleveland's important Easterly Treatment Works. Here he could picture the Dorr clarifiers of today in comparison with that pioneering unit of 1920, which

(1) *Pittsburgh Equitable Meter Co.* (2) *Aluminum Co. of America* (3) *Pacific Flush Tank Co.* (4) *Johns-Manville Co.*

(Continued on next page)

Exhibits (Continued)
(1) *Flexible Sewer Rod Co.* (2) *Royer Foundry Co.* (3) *Vapor Recovery Systems Co.*

went into an obscure plant in Florida on an "if it does the job" basis.

The Priorities Session

One of the main high spots of the program was the session given over to a review of the priorities situation as it affects sewage works maintenance and operation at present and what is apt to follow. Also, an interpretation of the then very new revision of the P-46 Order of the W. P. B. was presented by one of the two representatives sent out to Cleveland for the purpose by the Governmental Requirements Branch of the War Production Board, which is charged with all matters pertaining to sewerage and sewage treatment while the Power Branch now has complete jurisdiction over water works requirements. This session is given considerable space later on in this report.

Entertainment

While the entertainment was of a moderated degree, the ladies were given a luncheon, fashion show and bridge party, the men a "stag smoker," which was adequately tame to have had the ladies present also. On the final night the customary dinner and dance was held with a brief but high quality floor show provided.

New Officers

After the close of the Conference the Federation Board of Control met to elect officers for the ensuing year, hear and pass on many committee reports, attend to other business, pass the budget, and welcome into the Federation the hold-out New Jersey Association.

Officers for the ensuing year are:

President
George J. Schroepfer, Chief Engr., Minneapolis-St. Paul Sanitary District.

Vice-President
A. M. Rawn, Chief Engr. and Genl. Mgr., Los Angeles County (Calif.) Sanitation District.

Treasurer
W. W. De Berard, City Engr., Chicago.

Executive Secretary
W. H. Wisely, Supt., Champaign-Urbana (Ill.) Sanitary District.

Editor
Dr. F. W. Mohlman, Chief Chemist, Chicago Sanitary District.

Honorary Memberships

The Board made the following Honorary Members of the Federation:

Arthur S. Bedell, Engr., N. Y. State Dept. of Health, Albany.

Programmers
Captain Rolf Eliassen, U. S. Engineers, N. Y. City

Engineer C. A. Hansen, U. S. pH. Service, Atlanta, Ga.

Captain Guy E. Griffin, U. S. Engineers, Boston, Mass.

Julius W. Bugbee, Supt., Providence, R. I., Treatment Works.
Langdon Pearse, Sanitary Engr., Chicago Sanitary District.

Four Federation Awards to Be Established

Acting upon recommendations made by its special Committee on Awards through Professor Chas. Gilman Hyde as chairman, the Federation Board voted the establishment of the following awards subject to annual presentation.

The George W. Fuller Award—to that member making an outstanding contribution growing out of investigational work or research.

The George B. Gascoigne Award—to that member making a noteworthy contribution in the nature of improved plant or system operation or maintenance.

The Charles A. Emerson Award—to that member performing an outstanding service to the Federation.

The Kenneth Allen Awards—to members of the several member associations of the Federation to be made by each association annually in recognition of some deserving qualification, act or professional attainment of the member so honored.

The Board authorized the Finance Committee to find the necessary funds with which to finance these awards. A committee is to be appointed for the purpose of making the first awards during the 1943 annual meeting.

Central States Winner of Attendance Cup for Second Time

The cup which goes annually to that Association showing the best attendance record of members present at the Federation meeting was again for the second consecutive year won by the Central States group. The award is based not on total attendance but on man-miles of travel represented. The New York Association was again second. The record stands:

	Man-miles
Central States (68 men)	28,220
New York (48 men)	16,100
Ohio (52 men)	4,160

With only five men attending, California placed third in respect to man-miles, 9,700, and New England's 11 men chalked up 5,610 man-miles.

The Priorities Session

The meeting room was, as anticipated, crowded to hear the latest word from the War Production Board on priorities, allocation of materials, and interpretation of the then very new October 10th revision of W. P. B.'s P-46 Order as it af-

Easterly Plant Inspection Groups
(1) *Jerry McCarthy of Monanto, taking some notes*

(2) *J. W. Ellms, Cleveland's Sewerage Commissioner, and Stuart Coburn of Metcalf & Eddy Engrs., listen interestedly to Pioneer John Van Nostrand Dorr's story of getting over into the sewerage field from that of mining engineering*

(3) *"Doc" Mohlman puts one of those "Mohlie" questions to a fellow with the answers—Cleveland's Johnnie Wirtz*

(1) (2) (3) (4) (5)

(1)—*W. A. (Bill) Allen, Supt. Treatment, Pasadena, Calif.*
C. George Andersen, Supt. of Sewerage, Rockville Center, L. I.
(The meeting of Two Oceans)

(2)—*Stanley A. Kappe, Sales Engineer, Philadelphia*
Ray Trethaway, Sales Manager, Chicago
Both with Chicago Pump Co.

(3)
Symposium on Maintenance
Participants at Table
A. B. Cameron—"Plant and Grounds"
H. V. Crawford—"Electrical Equipment"
J. W. Johnson—"Mechanical Units"
R. L. Phillips—"Sewer Maintenance"
Leader
C. C. Larson,
Springfield, Ill.

(4)—*Milton P. Adams, Exec. Secy. & Engr., Stream Control Commission, Lansing, Mich.*
Wm. F. Shephard, Prin.-Asst. Engr., Michigan State Dept. of Health, Lansing

(5)—*W. B. (Bill) Marshall, Division Sales Manager,*
Chain Belt Co., Milwaukee
R. C. (Bob) Merz, Sales Engineer, Chain Belt Co., Milwaukee

fects sewerage operations and maintenance.

With Secretary Wisely in charge of the session and Priorities Clinic which followed, two representatives from the W. P. B. Bureau of Governmental Requirements were introduced—N. J. F. Von Steenberg and Malcolm Slaght.

Mr. Von Steenberg, in introducing the topic, stated that with the appearance of the new P-46 Order jurisdiction of the Governmental Requirements Branch over sewerage matters was clearly defined as complete and exclusive, whereas all matters pertaining to water supply were to remain completely within the Power Branch of W. P. B., located only across the street from the Governmental Requirements Bureau. Now the Bureau would concentrate on sewerage and had much to be grateful for in the action taken by the Sewage Works Federation, through Secretary Wisely and Vice-President George Schroepfer (now President), in the matter of getting an inclusive survey under way to determine normal and minimum requirements of materials and equipment in the operation and maintenance of sewer systems, pumping stations, and treatment plants. Already a dependable and representative picture of requirements for use in allocation of materials was developing with the valuable aid of Mr. Schroepfer as Consultant to W. P. B. Mr. Wisely had mailed out the rather detailed questionnaires to all important and a representative number of the smaller plants. A return of 56 per cent had been received in the brief period, which indicated that the survey would be very complete and representative of anticipated sewage works requirements for the duration. Again he expressed appreciation to the Federation for its splendid help and assured his audience that water supply and sewage disposal would continue to be classed as firsts in all municipal requirement ratings in W. P. B. Mr. Von Steenberg made a highly favorable impression.

Programmers

Le Roy W. Van Kleeck, Prin. Asst. Engr., Conn. State Dept. of Health, Hartford

Dr. William Rudolfs, Chief, Dept. of Water and Sewerage Research, Agricultural Exptl. Sta., New Brunswick, New Jersey

Alec. B. Cameron, Supt. Treatment Works, Jackson, Michigan

L. Malcolm Slaght, representing the Processing Division of the Governmental Requirements Bureau, made the error of consuming far too much time in his presentation and we wonder where he got the idea that he had to talk down to a sewage workers' audience. His job could have been far more effectively done if he had avoided the idea that he had to be humorous or that he was at all expected to cast aspersions in the direction of the Power Branch of his own organization. When Mr. Slaght got down to the business of the day he had the following to say regarding the revised P-46 Order of October 10, which applies equally to sewage as to water works operation and maintenance.

Mr. Slaght stressed the point that a major national responsibility had been placed on the water and sewage authorities who under the P-46 Order could pretty much write their own ticket in procuring materials for operation and maintenance. Such a situation was evidence of the confidence shown by W. P. B. in water and sewage works authorities and placed conservation for the duration as much in their hands as in W. P. B.'s.

In referring to the new order placing sewage matters exclusively

(1) (2) (3) (4) (5)

(1)—*Lunching at Easterly Works*
John Brooks, Genl. Supt.
Roy Lanphear, Supt. of Treatment, Dept. of Sewerage, Worcester, Mass.

(2)—*"Doc" Wm. D. Hatfield, Supt., Decatur, Ill., Sanitary District*
Stuart Coburn, Chief Chemist, Metcalf and Eddy Engrs., Boston, Mass.

(3)
Sanitary Engineering Students Case School of Sciences, Cleveland
(From left)
W. H. Davis. W. C. Brewer,
H. J. Vokoun, J. S. Stock,
W. J. Wishchmeyer

(4)—*Mathew M. Braidech (left), Prof. Industrial and Sanitary Chemistry*
George E. Barnes (right)
Prof. Hydraulic and Sanitary Engineering
Case School of Science, Cleveland's "Jo" Ellms,
Who Case honored with degree of Sanitary Engineer

(5)—*"A. M." Rawn, (Assoc. Editor, W. W. & S.) Los Angeles County's Chief Sanitary Engr. and new Vice-President of the Federation telling our Scranton Gillette "What every publisher should know."*

(1) (2) (3) (4) (5)

(1)—*Gerard J. Hoerbelt, Engr. of Maintenance,*

Theodore C. Schaetzle, Supt. of Treatment, Division of Water and Sewerage, Akron, Ohio

(2)—*"The Pennsylvania Gang"*
George Boone, Supt., Norristown,
"Jim" Schertzer, Supt., Lancaster,
"Gene" Swineheart, Supt., Pottstown,
"Stan." Pearson, Supt., Consohocken

(3)—*WESTERNERS*
(All being supts. of Treatment Plants)

G. C. Ahrens, Omaha, Neb.

J. L. Strelow, Davenport, Ia.

T. R. Lorell, Marshalltown, Ia.

(4)—*All of Nichols Engineering—New York*
R. W. (Bob) Owen—Vice President
Brannen B. Selph—Sales Engineer
Mark B. Owen—Vice President
(Who put sludge incineration on the map)

(5)—*Charlie Hommon, Sanitary Engineer, Canton, Ohio*
(An operator since 1912)
John A. Montgomery, Vice Pres. and Engineer,
Lakeside Engineering Co., Chicago

in the Governmental Requirements Branch, Mr. Slaght promised sewerage authorities a great deal when he guaranteed that applications on the PD-200 forms covering replacements, extensions and betterments would receive a 24 hour service in most instances—in others not more than 48 hours for action and advice to the applicant.

Mr. Slaght pointed out that the new P-46 permitted sewage works managers to use the same favorable AA-5 ratings in sewage as in water for materials and equipment replacements required in production (pumping and treatment of sewage), repairs, operation and maintenance. Also that the special AA-2x rating on water supply operations applied to sewage works materials and equipment needed to forestall an anticipated breakdown as well as in an actual emergency—not foreseen and prepared for. In underground construction (pipe lines or sewer lines) the expenditure of $1,500 for *materials* required is permissible. Any betterment above ground is limited to expenditure of $500 for materials. Anything to cost more in materials alone must be subject to special PD-200 or PD-1A applications for authorization to proceed and a priority rating. If above $2.500 in total cost, the PD-200 application form must be executed and filed. For less costly betterment ($2,500 downwards), the simpler PD-1A application is to be used.

As to other limitations now imposed by the P-46 Order on sewage as well as water operations, the following apply:

(1) Extensions of pipe lines and sewers or laterals are limited to 250 ft., anything more requiring the PD-200 or PD-1A applications. Even so, no extensions of any nature are longer permitted to new buildings which did not have foundation completed before July 1, 1942.

(2) Deliveries of materials for maintenance, repair and operation cannot exceed in any single quarter (3 months) 25 per cent of the dollar value of total requirements for the year 1940. However, an increase is permitted in ratio to the increase in population served since 1940.

(3) Total dollar value of materials for the year may now not exceed 60 per cent of those purchased or used in the year 1940. This limitation applies not only to materials to be purchased during the year but likewise to materials already in stock. This is equivalent to saying that where 1.66 lbs. of materials were required in 1940, only 1 lb. is permitted for the year October, 1942, to October, 1943.

All of the above means that minimum service and standards is for the present the order of the day in sewage disposal as in water supply. However, when it comes to production of safe water in ample quantity or the matter of adequacy of health protection in sewage disposal, there is nothing in the revised P-46 Order which can be held to make either excusable.

In reply to questions, Mr. Slaght had the following to say:

If the plant had no 1940 inventory records as a guide in determining permissible use of materials for present, the matter may be settled by a special letter to the Governmental Requirements Bureau. It may prove possible to set a base figure from the present survey figures. There would have to be a different "base" for each process of treatment, which complicates the matter. Again the sewage works manager must be relied upon in many cases to do with a bare minimum and every possible substitution of non-critical materials in replacements and repairs.

If the application forms seem complicated, just attach a fully explanatory statement covering the needs and in particular the reasons therefor. Such statements of fact had better be too lengthy than too brief. In the future *all* such applications should be directed to the Governmental Requirements Bureau of the W. P. B., regardless of the fact that the water and sewage utilities may be within a single department or that water works income may be used to defray sewage works operating expense.

Regarding placing of the AA-2X rating on orders considered emergency orders, there will be no need to record such orders with the W. P. B. unless the 30 per cent limit on such orders, when compared to similar materials which can be scheduled under the 60 per cent limitation, is exceeded. In such case a PD-1A application should be speeded through, following it up by telephone or telegraph to the Bureau. Such applications can *not* be handled by W. P. B. District Offices. Neither can District Offices issue or approve ratings.

Survey Findings

At this juncture George Schroepfer presented a consolidated table of sewerage materials requirements per year developed from figures reported on the Federation survey questionnaire forms. They are interesting.

Collecting Systems	*Lbs./1000 Population**	*National Totals* (Pounds)*
Castings (Pipe and others)	473.	37,800,000
Steel and iron	31.2	2,500,000
Rubber Goods (boots, etc.)	4.85	387,000
Treatment Works		
Ferrous metals	115	5,700,000
Non-Ferrous:		
Brass, bronze, copper	2.95	148,000
Lead	0.95	47,500
Aluminum..	0.73	36,500
Paints (other than aluminum) ...	0.80	40,000
Rubber		

(1) (2) (3) (4) (5)

(1)—*Theo. S. Bogardus, Havens and Emerson, Cleveland*
and
Curry E. Ford, National Carbon Co., Cleveland
(Managed the Registration Desk; did a good job)

(2)—*E. H. Paffrath, Commissioner of Sewerage,*
and
Guy H. Brown, Chief Engr., Sewers and Streets, St. Louis, Mo.

(3)—*A Bit of Post Session Round Table "Doc" Mohlman; "Doc" Ruchhoff; "Doc" Rudolfs (rear view); and Plant Managers Bloodgood of Indianapolis, and Allen of Pasadena. (But, we need help with the 6 foot leg of this table on the extreme right)*

(4)—*Representing "Water Works and Sewerage"*
E. Scranton Gillette, General Manager and Vice Pres., Chicago
Burt Brumm, Cleveland District Manager

(5)—*Ohioans*
Elmer L. Pollex, Foreman of Maintenance, Toledo
and
Linley B. Barnes, Supt. of Treatment, Bowling Green

(boots, hose, etc.)	2.78	139,000
Fuel oil ...	97.70 (gals.)	4,900,000
Gasoline ...	13.50 (gals.)	670,000
Chlorine ...555.		27,800,000

*The pounds per 1,000 population served are as reported. To arrive at the probable National Total figures the U. S. population known to be served with sewage treatment was used.

Sewage Works Federation Conference Technical Papers and Discussions

(Reported by Harry A. Faber, Associate Editor*)

"Sewage Purification by Flotation," by C. A. Hansen, Asst. Engr., U. S. P. H. S., Res., Atlanta, Ga., and Harold B. Gottas, Chief, Engr. Section, Div. of Health and Sanitation, Coordinator of Inter-American Affairs, OEM, Washington, D. C.

The authors reported on the study of a considerable number of special flotation reagents, chemical substances developed for ore flotation processes, as applied to treatment of sewage. Most of the reagents were found to be not applicable to flotation of sewage solids, but one was selected as showing the greatest promise and extensive experiments with it were carried out. A trade preparation designated as DP2-143 was used in conjunction with aeration for laboratory tests.

For flotation studies, sewage samples were aerated in 1 liter cylinders and the froth was collected in shallow pans in which the cylinder stood. Batch tests and continuous flow tests were reported upon. Results of these studies were illustrated in a series of slides.

Characteristics of the raw sewage treated were: BOD 180 ppm., suspended solids 160 ppm. Throughout the various tests, a 60 ppm. dose of the selected reagent and a 15 minute aeration period were employed, since no improvement was noted when larger doses or longer aeration times were studied. Removal of suspended solids by this treatment averaged 95 per cent or better. Since a preliminary settling period of only 10 to 15 minutes preceded the aeration step, very limited detention capacity appears suitable in this process.

After maximum removals were obtained with aeration and DP2-143 alone, the effect of adding ferric sulfate and of adding activated sludge seed was studied. Use of these secondary processes showed no material improvement. Aeration with the flotation reagent provided an effluent whose oxygen content remained high for a considerable period of time, apparently because the chemical has a bactericidal effect. Temporary reductions in numbers of bacteria approach 100 per cent, and this accomplishes, together with removal of suspended solids, a BOD reduction of 50 to 85 per cent.

Digestibility of the floated sludge was considered important. Mixtures of 25 per cent floated sludge and 75 per cent deep sludge digested well, digestion being 85 to 90 per cent complete in 20 days. But digestion of 50-50 mixtures was not good; apparently there was insufficient deep sludge to counteract the effect of the added flotation reagent.

In the authors' interpretation of results, this treatment method gave results superior to usual treatment methods because of the high removals of suspended solids and of bacteria. Both settling time and aeration time required are very short. While the type and dose of flotation reagent make this treatment too costly for practical operation, further study seems warranted since more effective reagents may be developed.

Rolf Eliassen (Captain, Corps of Engineers, U. S. A., Office of Division Engineer, North Atlantic Division, New York) discussed this paper. He reviewed early studies of flotation treatment and noted that the application of laboratory results was of major concern to sanitary engineers. While chemical doses of 60 to 80 ppm. as recommended are comparable to present practice in chemical treatment, the cost of flotation reagent of 40 to 50 cents per pound does not compare with the usual reagent cost of one to two cents per pound.

The main purpose of sewage purification is not bacterial removal (as this function is already well served by chlorination) but the removal of putrescible materials. Nevertheless, work of this nature often reveals that one specialized field can adapt developments from another field.

"Sewage Treatment Problems in Cleveland," by J. W. Ellms, Commissioner of Sewage Disposal, Department of Public Utilities, Cleveland, Ohio.

Mr. Ellms described the long history of legislation affecting the history of sewage treatment in his city. Construction of the first interceptor to abate sewage nuisance was started in 1898 and experiments in treatment of sewage by activated sludge were undertaken in 1917. The first disposal plant was built in 1922

"Aces"

Van Porter Enloe, Supt. Treatment, Atlanta (Georgia Assns. new secretary and Federation Director)

Wm. C. Hamm, Supt. of Sewerage, Port Washington, L. I. (An addition to the Quarter Century Operators Club)

George E. (Doc) Symons, Chief Chemist, Buffalo, N. Y. (Official Federation Reporter. Knows how to do things; gets them done)

*Research Chemist, The Chlorine Institute, New York, N. Y.

(1) (2) (3) (4) (5) (6) (7)

From Ocean to Ocean

(1)—*Wm. A. Allen, Supt. Treatment, Pasadena, Calif. (Federation Director)*
(2)—*F. W. Gilcreas, Chemist, N. Y. Dept. of Health, Albany (Heads Publication Committee)*
(3)—*Kerwin L. Mick, Chief Chemist, Twin-Cities Treatment Works, St. Paul (President Central States Assn.)*
(4)—*Matthew M. Braidech, Professor, Sanitary and Industrial Chemistry, Case School of Science, Cleveland*
(5)—*W. M. (Bill) Platt, Consulting Engr., Durham, N. C. (Federation wheel-horse since the beginning)*
(6)—*"Doc" Anthony J. Fischer, Development Engr., The Dorr Co., New York, N. Y. (J. Van Nostrand D. knew his man)*
(7)—*C. George Andersen, Supt. of Sewerage Rockville Center, L. I. (Sec'y., Long Island Section, N. Y. Assn. and Federation Director)*

(Westerly plant) as a primary sedimentation unit, costs being borne by the bureau of water.

The State Supreme court in 1928 rendered a judgment declaring payment of sewage costs from city funds to be illegal, and not until 1935 was the city's Bureau of Sewage created as a new division. In that year a sewer rental charge of 40 per cent of the consumer's water bill became a city ordinance. Many subsequent changes in rates have been made, because while sewer rental charges have been supported by the majority of voters, a small minority blocks adoption of such charges.

The author stated that "the question which the court must decide is whether the charging of a rental makes such a service a utility which can finance its support by such a rate or whether it is a governmental function which should be supported by a general tax." The ruling of the Attorney General that a rental charge is neither a tax nor an assessment leaves its status still undetermined. Total costs of sewage treatment for the city is more than two million dollars yearly, and in certain years insufficient funds have been available for adequate treatment.

Industrial activity has now created new problems of plant operation, it being the general policy of the city to permit discharge of most trade wastes into sewers. Wastes such as acids, pickling liquors, oils, and greases are proving especially troublesome. Certain equipment must be replaced but substitutes are not always available.

Total number of plant employees has remained about the same since 1938, about 225 to 230 men, but the personnel has a higher level of intelligence. This has been of great advantage since technical details of treatment processes are widely different within the last few years. The merit system applied has some advantages and some disadvantages.

John J. Wirts (Superintendent Division of Sewage Disposal, Dept. of Public Utilities, Cleveland), in discussing Mr. Ellm's paper, noted that there are now only three engineers with the department who have more than ten years' experience in the same job. Improvements are designed as required, and all projects are maintained up to date by the utilities department or by the consulting engineers.

Cleveland has pioneered in activated sludge experiments, in the use of glass covered sludge drying beds, in the installation of large comminutors, and in the use of aluminum equipment. A relatively new development is the application of nonferrous alloys, for example, tungsten-carbide for cutter shear bars and pump wearing rings.

"Operation of Army Sewage Treatment Plants," by Lewis H. Kessler and John T. Norgaard, respectively, Chief and Associate engineer, Water, sewer and Services Unit, Repairs and Utilities Branch, Construction Division, War Department, Washington, D. C.

Mr. Kessler presented data from the operation of 46 sewage treatment plants located on Army posts, though names of the posts were not given, and Mr. Norgaard showed slides to illustrate plant equipment and results being obtained. Under the decentralized program now largely attained, substantial improvements in operation are becoming evident.

Grease has provided a treatment problem from the start of operations, but the installation and proper servicing of traps has now resulted in the collection of about six million pounds of grease monthly. This is of special value since some 600,000 pounds of glycerine (for nitroglycerine) can be produced therefrom.

The heating of steel digestion tanks and maintenance of temperature at 85 degrees has proven difficult. Provision of blackout facilities for waste gas burners required special study.

Mr Kessler devoted considerable discussion to the Hays process (contact aeration) plants, of which 27 are now in operation. Only four of these are giving satisfactory service, most having inadequate laboratory facilities and supervision. Indications are that these plants require more than the 1.5 cu. ft. per gal. of air which is provided in the design capacity, if good results are to be obtained.

For practical operating considerations, single stage filters have been found adequate and no need has been found for the two stage type. Chlorinations of mixed liquor in activated sludge treatment plants (about 2.5 ppm. dose) has given good results in controlling bulking.

The extensive data presented, too fully to summarize, represents the best results to be expected under present operating conditions. The variety of plants should provide data of basic value for designing engineers for future improvements.

Guy E. Griffin (Captain Corps of Engineers, U.S.A., Office of Division Engineer, New England Division, Boston, Mass.) commented on this paper with particular reference to the New England area. Sewage flows have been materially reduced (averaging reductions of from 108 down to 60 gal. per capita per day) largely through the installation of flushometer valves. Recovery of grease can be further increased by

improved supervision. The installation of baffles to retain floating solids has enabled the removals of suspended solids and of BOD to reach 94 per cent. Several additional examples of specific accomplishments depending on specialized plant study were reported.

"Wartime Sanitary Problems of a State Department of Health," by W. F. Shephard, Assistant Engineer, Bureau of Engineering, Department of Health, Lansing, Michigan.

The construction of defense industry plants of unknown size, which will contribute wastes of unknown quantity and characteristics, has given Health Departments their share of problems, according to Mr. Shephard. Sanitary conditions in McCombs County provided an outstanding example of this condition in his state. The District was bankrupt financially and was unable to carry the load of construction forced upon it.

A specific plan to provide trunk sewers was available, ready for action to be taken. The story of the many difficulties between offering the plan and its acceptance illustrates the personal problem involved. State legislative action, approval of an enabling act, presidential approval in Washington and the infinite number of duplicated investigations —did result in action being taken, but only some twenty months after the application had been made.

Ypsillanti County was selected as a site for the Ford Willow Run bomber plant over a year ago and the population has risen from 30,000 to 60,000. But due to the extraordinary co-operation of this company with the State Health Department in industrial waste problems, an activated sludge treatment plant has been constructed and in operation for over two months.

Sewage and waste treatment was not the only problem, however, since there was no known source of water supply for this area except Detroit. Long distance provision of water in this instance, and long distance provision of sewage facilities in others were examples cited.

In 1941 a state law was enacted to require the licensing and supervision of trailer parks. The examination and introduction of sanitary facilities (average water consumption is 45 gal. per capita per day) has added considerable work. Only a small proportion of these parks can satisfy the requirements for unqualified licenses.

Michigan appears to have suffered less than many states from loss of engineering personnel. The construction of several new plants has, of necessity, been deferred—but generally plants have not suffered seriously from industrial wastes. Mr. Shephard said the state was not disposed to save fish life or to solve sanitary problems at the expense of the war effort, but neither would unnecessary conditions of stream pollution be tolerated.

Wm. D. Hatfield, Superintendent, Decatur, Ill., Sanitary District (Went to college to be a violin virtuoso; switched into water purification—and NOW see what he's come to be)

E. F. Eldridge, Research Engr., Michigan State College, E. Lansing, Mich. (Recently produced the first text on "The Treatment of Industrial Wastes")

John J. Wolfmann, Consulting Engineer, Bloomington, Ill. (Many travel far to see the plant he designed and Bloomington beautified)

"The Pre-Treatment of Chemical Wastes," by Dr. Willam Rudolfs, Chief, Dept. of Water and Sewage Research, N. J. Agricultural Experiment Station, New Brunswick, N. J., and W. R. Graff, Asst. Supt., Merck & Co., Rahway, N. J.

Dr. Rudolfs, hampered by inability to show lantern slides, presented briefs from his paper recounting experiences with acid industrial wastes discharged by a large industry resulted in considerable difficulty at a sewage treatment plant. A plant to pre-treat the wastes was built for the purpose of partial equalization and complete neutralization of the wastes. The acid wastes amounted to roughly 15 per cent of the total sewage flow. Measurements showed that very little mixing took place in the sewer over a distance of 3,000 ft.; the acid wastes moving in slugs. Operation of the pre-treatment plant shows that retention of the waste for as short as one hour caused material equalization. Effective neutralization is accomplished by means of concentrated lime slurries, the quantities of hydrated lime required averaging about 1,440 lbs. per million gallons.

"The Need for Short Training Schools in Sewage Treatment During the Present War Emergency," by H. E. Babbitt, Professor of Sanitary Engineering, University of Illinois, Urbana, Ill.

In the author's absence this paper was read by title only. It will probably be published in Sewage Works Journal.

SEWAGE PLANT MAINTENANCE IN WARTIME

(A Symposium)
Reported by
Dr. George E. Symons, Buffalo, N. Y.

The Friday afternoon session, presided over by A. H. Niles, chairman of the Ohio Conference, was taken up with a symposium on "Plant Maintenance in Wartime" under leadership of C. C. Larson of Springfield, Ill. This being a repeat assignment as the result of the similar job that he handled so well at last year's meeting in New York. Maintenance problems were covered in four phases, namely, Mechanical Equipment, Electrical Equipment and Power, Grounds and Plant Protection, Sewer Maintenance.

"Mechanical Units," by John W. Johnson, Works Superintendent, Buffalo Sewer Authority, Buffalo, N. Y.

Naming Priorities, Rationing, Substitution, and Labor Turnover as the Four Horsemen of the 1942 Apocalypse, Mr. Johnson presented some means of combating these problems. Where mechanical units are concerned, one must take care of what one has, no matter how small it may be, as it is most vital in the light of replacement. Mr. Johnson advocated the use of employes' suggestions as a means of saving materials, the revision of old equipment to new uses, the substitution of relatively inexpensive, non-critical materials for scarce metals, as well as experiments to improve the life of various items such as filter cloths, filter wire, etc.

In discussing a few particular problems at the Buffalo plant, Mr. Johnson pointed out that abrasion of incinerator equipment by the extremely fine sand in the digested sludge had seriously affected cyclone liners, fuel lines, flash dryer equipment, and other parts of the incinerators. Liners of brick have been used in the cyclones, but four inches of thickness of these bricks have been worn through in about fifteen months. Latest replacement has been a packing house tile which experimentally showed an abrasion resistance about that of manganese steel liner plates, now no longer available. Replacements of sludge pumps with a Meehanite iron is now in progress as rapidly as the original cast iron pumps fail because of high pressures. Replacement or substitution of a wooden baffle for steel in the clari-

(1) (2) (3) (4) (5) (6) (7)

(1)—*Harvey P. Jones, Consulting Engineer, Toledo, Ohio*

(2)—*Glenn Searls, Supt. Treatment, Rochester, N. Y.*

(3)—*Maxfield Pease, Chief Sales Engr., S. Morgan Smith Valves, Cleveland*

(4)—*Harry R. Crane, President, Flexible Sewer Rod Co., Los Angeles*

(5)—*R. S. Rankin, Manager, Sanitary Div., The Dorr Co., New York City*

(6)—*Wm. R. Gelston, Supt., Water and Sewerage, Quincy, Ill.*

(7)—*Howard Power, Sales Manager, Flexible Sewer Rod Co., Los Angeles*

fiers and of hard rubber and plastic materials in chlorine machines for Isolantite were other items mentioned.

Mr. Johnson also pointed out that loss of qualified and experienced personnel contributes to the problems of operating as well as maintaining mechanical units, and suggested that we perhaps may look forward to women machinists and mechanics. In this direction, Mr. Johnson pointed out that "Ed" Smith, of Niagara Falls, has already placed four women operators in the chlorination department of that plant.

Mr. Johnson concluded by stressing the fact that good housekeeping and care, both in operation and in maintenance of equipment, with substitution where possible, must be the watchword of the sewage plant operator in the maintenance of mechanical units if plants are to continue to function for the duration.

A. M. Rawn, Chief Engineer and General Manager of the Sanitation Districts of Los Angeles County, discussed Mr. Johnson's paper, telling of his recent visit to Buffalo. As one example of "doing with what one has," Mr. Rawn reported that an old concrete tank had been covered with a wooden cover and a live steam line run into the tank, thereby making a heated digestion tank of it without the cost of coils. Mr. Rawn pointed out that California problems are not the same as those in the east; particularly there is a lower per capita flow and sludge may be recovered and used on orange groves and elsewhere.

W. A. Allen, Superintendent of Treatment at Pasadena, Cal., told of melting old babbitt bearings and making new ones in the absence of new babbitt, while W. D. McIlvaine, Junior Assistant Engineer, of St. Paul, Minn., inquired if babbitt substitutes had been tried by anyone and suggested that we may yet have to use silver. No reports of the use of substitutes for babbitt were made.

Continuing on the matter of substitution, *LeRoy Van Kleeck*, of the Department of Health of Connecticut, told of wood being used for bar screens and tide gates, and *W. W. Matthews*, Superintendent of the Gary, Ind., plant, told of wooden bearings for the agitators in digestors. These have now been operating for three months. *A. H. Niles*, Superintendent of the Toledo, Ohio, plant, substitutes babbitt for bronze wearing rings, machining out the inner ring and adding babbitt to the outer ring to produce the proper clearances.

The question of galvanic or electrolytic corrosion was raised by *J. R. Collier*, Superintendent of Treatment, at Elyria, Ohio, who told of wrapping pipe with a specially treated paper. *A. B. Cameron*, Superintendent of Treatment, at Jackson, Mich., suggested the use of sacrificial zinc strips, and *H. V. Crawford*, of the General Electric Co., of Schenectady, suggested cathodic protection. The latter method was also discussed by A. M. Rawn, who told of some four years' operation with cathodic protection and sacrificial metals in a digestor in California. *C. C. Larson*, of Springfield, Ill., reported observing the failure of rivet heads on links of a straight line sludge collector. The failure appears to be where the rivet has been peened. He questioned that the corrosion is galvanic in this instance, and believes that it has to do with the effects of peening on molecular structure in combination with secondary effects of oxygen in the aerated sewage.

"Electrical Equipment and Power Sources," by H. V. Crawford, Industrial Engineering Department, General Electric Co., Schenectady, N. Y. The maintenance of electrical equipment is decidedly different from that of mechanical equipment. There is no indication by sound that trouble has occurred or is imminent in electrical equipment, whereas this factor is often important in spotting difficulties in mechanical operation. In the proper maintenance of electrical equipment, Mr. Crawford stated that the operator must combat (1) moisture, (2) heat, and (3) dirt. Wear is usually confined to switches, brushes and bearings. The operator should, therefore, keep the temperature down, keep bearings and windings dry, and watch the brushes.

Standby equipment should be operated as often as once every seven to ten days in order to be sure that it will be in good operating condition when needed. Power companies

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Association Representatives to Federation Board

(1)—*George Russell (Missouri) Russell and Axton, Engrs., St. Louis*
(2)—*Wm. Q. Kerr (Missouri) Asst. State San. Engr., Jefferson City*
(3)—*C. D. McGuire (Ohio) Supt. Treatment, Columbus*
(4)—*Edw. P. Molitor (New Jersey) Plant Supt., Springfield, N. J.*
(5)—*Joe Williamson, Jr. (Florida) Consulting Engineer, Daytona Beach*
(6)—*John H. Brooks, Jr. (New England) Supt. of Sewerage, Worcester, Mass.*

usually maintain transformers, but if not, the operator should check the oil in all insulated transformers, observe the ambient temperature, make sure that there is proper ventilation, and that the overload, if any, is approved by the power company. Spare transformers should be checked regularly and painted to prevent corrosion. Conduit boxes should be sealed to keep dry and prevent possibility of moisture entering the conduit pipes, thereby causing shorts.

"Motor maintenance is the chief thing in sewage plants," said Mr. Crawford, "and it is necessary to determine that the motors are of the proper size, character and construction." Insulation on motors should be checked for heat charring. If the temperature of a motor is too high, and high outside temperature is the cause, it should be properly ventilated. However, if the heat is generated within the motor, the load on the motor should be reduced.

All efforts should be made to prevent oil from being splattered on the insulated wiring. If motors are operated infrequently, there may be moisture within them. The insulation resistance should be checked and the motor dried out, either by putting through low current or by outside heat. This process should be done especially on the installation of new motors which have been stored in warehouses or elsewhere. Motors should be cleaned of dust, preferably by suction, rather than by low pressure air jetting, or they may be taken out of service and washed with carbon tetrachloride and a soft brush. When dry and while warm, motor windings may be varnished. Brushes should be kept free from dirt and a good fit should always be maintained.

A record of inspection and checks on bearings and a check on the rotor air gap (in the case of sleeve bearings) should be made at regular intervals. Grease should be added to motor bearings when running, and all old oil should be run out of the motor as the new oil is run in. To determine the temperature of a motor, insert the bulb of a thermometer in a roll of soft putty and stick the putty on the housing of the motor.

In the matter of control equipment, Mr. Crawford said that accumulations of dirt and water should be prevented both by protective paints and varnishes applied two to four times a year, and by systematic programmed inspection and cleaning. Operators should check pigtail connections and float switches. In the case of mercury float switches, if the tubes have darkened, an air leak is indicated. Float wires or tapes, chains, and so forth, in float wells should be checked at least once a year.

(1) (2) (3) (4) (5)

(1)—*B. K. Hartmann, Engineer, Link Belt Co., Chicago*

(2)—*C. A. Hardy, Asst. Operator and Chemist, Olean, N. Y.*

(3)—*F. P. Fischer, Distr. Mgr., W.&T. Co., Cleveland*

(4)—*Roy F. Weston, San. Engr.-Chemist, Atlantic Refining Co., Philadelphia*

(5)—*John D. McDonald, Engr. and Plant Supt., Springfield, Mass.*

In summarizing, Mr. Crawford presented the "K" formula for proper maintenance as follows:

Keep it dry.

Keep it clean.

Keep it properly lubricated.

Know its condition at all times.

Know that its load is not beyond its Kapacity.

Korrect the weak points before failure.

Keep a record of regular inspection.

And, as added precaution, Mr. Crawford presented the following Don'ts:

Don't expect it to operate without inspection and maintenance.

Don't hesitate to call an expert if trouble arises.

Don't let just anyone work on the equipment.

Don't think you need a manufacturer's representative. You can use local electrical experts.

Don't send motors to the manufacturer without first having them request you do so.

Don't run motors without knowing how they are loaded.

As a practical example of the importance of Mr. Crawford's remarks, Morris Cohn, Sanitary Engineer of Schenectady, N. Y., told of maintaining a motor for 15 years, after it had been condemned, by giving it all of the care outlined by Mr. Crawford, whereas another motor, relatively new, failed in a few minutes for lack of attention.

Two questions were asked of Mr. Crawford, one by Harold R. Fanning, of the Eclipse Machine Division of Bendix Aviation at Elmira, N. Y., and the second by Van P. Enloe, Plant Superintendent of Atlanta, Ga. The first was, "How should one keep electrodes from grounding in wet well elevation switches?" To this Mr. Crawford replied that the usual trouble is with poor wire and improper installation. The second question concerned the possibility of jumping a coil in a motor if it is shorted. To this Mr. Crawford replied that it is possible, but that the coil should also be cut from the ground and that the operation would probably give trouble if the motor were random wound.

"Grounds—Including Visitors and Protection," by A. B. Cameron, Superintendent, Sewage Treatment Plant, Jackson, Mich.

Since visitors look at the grounds rather than the data of the sewage treatment plant, "It is good business to landscape the ground, even to the extent of employing landscape architects for such layouts," said Mr. Cameron. In the case of Jackson, Mich., hardy trees and shrubs were used with suitable arrangements of flower beds to provide rotating blooms. Among the many salient features of Jackson's landscaping are a softball diamond, lagoons for ducks in the summer and skating in the winter, rock gardens and flower beds, roads and walks, and an underground sprinkling system using settled final effluent and capable of distributing water equivalent to 1 inch rain in 1 hour. Top soil was made from sand and 6,000 tons of sludge. Picnic tables are spotted throughout the grounds which contain 10,000 shrubs and 1,500 trees of some 150 varieties.

The project was constructed by W. P. A. labor and cost $230,000. Six men working six months a year at a cost of $4,000 maintain the grounds in attractive condition. This expenditure pays dividends, not only in the favorable news comment received, but in the fact that no complaints about the plant or expenses have been made by city officials and no request by the plant has been denied by the city officials in five years. Requests for use of the ball diamond

(1) (2) (3) (4) (5) (6) (7)

(1)—*R. E. (Bob) Weber, Distr. Mgr., Mathieson Alkali Wks., Cincinnati, O.*

(2)—*H. D. Lautenschlager, Supt. of Sewerage, Orrville, Ohio*

(3)—*Lee H. Chamberlain, Eastern Manager, American Well Works Co., Aurora, Ill.*

(4)—*Floyd G. Browne, Sanitary Engr., Marion, Ohio*

(5)—*Roy L. Phillips, City Engineer, Meadeville, Pa.*

(6)—*J. D. Collier, Engineer, W. K. Porteous, Ltd., Montreal and London*

(*Quarter Century Operator, boasting 29 years of service*)
(7)—*George Behnke, Supt. Sewerage, Oberlin, Ohio*

are so numerous that its use must be allotted and the picnic tables are usually filled throughout the summer evenings. There have been few abuses of the privileges, these mostly by children, but steps to prevent their use of the park have not been warranted. Some speeding has occurred on the roads at night, resulting in the sewage plant grounds being closed from 10 p. m. until 6 a. m.

As to the question of what to do with the sewage plant grounds during the war, Mr. Cameron said that there are two views: (1) that there would be sabotage and that protection was, therefore, necessary, and (2) that there would not be sabotage, particularly directed towards the sewage treatment plant. For several months the City of Jackson followed the first idea and closed the grounds to the populace, but the citizenry objected because they were accustomed to having the grounds available and also they wanted sludge for Victory Gardens. After several months, Jackson went back to the peacetime conditions of opening the plant during the daytime. Watchtowers (with lights) and guards at the gate at night have been provided.

Comments regarding landscaping and parking of sewage plant grounds were fewer than those regarding the protection of the grounds and sabotage. *Stewart Coburn,* Chief Chemist of Metcalf & Eddy, asked, "In the case of such elaborate landscaping, is the superintendent's salary charged to the Department of Parks or the Department of Sewage Treatment?" *A. M. Rawn,* of Los Angeles, observed that the Golden Gate Park in San Francisco was largely responsible for its existence to sweepings from the streets and to sewage effluent and sludge. The activated sludge plant on the Island provides the water supply, the sludge provides the top soil, and the effluent is also used for the duck and swan ponds. *Roy L. Phillips,* City Engineer of Meadville, Pa., told of developing a nursery by the expenditure of $500 for young trees which have now grown to be worth $4,000. These are being sold to citizens. *Van P. Enloe* of Atlanta, Ga., trades sludge for shrubs. *C. C. Larson* of Springfield, Ill., favored a clean plant and laboratory because it means to him good orderly thinking, planning and operation.

In regard to the matter of possible sabotage at the sewage treatment plants and the protection required, Mr. Coburn said that he believed that sewage treatment was a serious business and, therefore, needed serious thought and protection. *T. C. Schaetzle,* Supt. of Treatment, Akron, Ohio, raised the question as to the effluent of one plant affecting the water intake of a war plant, as well as public health, and therefore the possible need for protection. *A. M. Rawn* stated that there is the definite danger of sabotage, particularly in the west, and that protection must be given to the sewers so that saboteurs could not float bombs down the sewers to be exploded at critical points. One small plant has been sabotaged, according to Mr. Rawn, with dynamite caps placed in the suction of a lift station centrifugal pump. Two pumps were destroyed. Mr. Van Kleeck told how surveys had been made of war industries with the result that manholes near these industries were locked. Buffalo has employed guard fencing, guards, at the request of the U. S. Army Engineers because the site lies next to a canal and bridge. At Alliance, Ohio, the F. B. I. requested that the plant be guarded; at Toledo the plant has been declared in a restricted area at the request of the U. S. Coast Guard. Upon inquiry by Mr. Niles, the chairman, it was found that eleven plants are closed 24 hours a day, eighteen plants are now open during the daylight only, and twelve plants are not closed to the public and have no particular protection.

"Maintenance of Sewers," by Roy L. Phillips, City Engineer, Meadville, Pa.

Maintenance costs on sewers can be cut by better design and more cooperation between the designers and the builders, with emphasis placed on proper construction of house connections. Where possible, reconstruction should be for the purpose of making easy maintenance. More manholes generally should be added. Catch basins are wrong on short lines, as receivers are on long ones. Regardless of all efforts, there must be some places where there will be trouble. Root cutters have their distinct advantage. "Whereas certain troubles may be expected in certain districts, one does not usually expect to find a manhole completely filled with coal ashes," said Mr. Phillips, but that happened.

In cleaning sewers, a disc should always be pulled through to make sure that there are no small objects such as a brick, about which sludge or sand will settle to form a dam. Emphasis in sewer cleaning should be on safety; care should be taken that manhole steps are inspected and that gas in sewers should be determined. Blowers, safety belts and gas testers are equipment that should be available and used to the fullest extent.

One tool which Mr. Phillips finds indispensable is a rotating brass nozzle which will effectively remove at least three types of obstructions, roots, grease, sticks, or rocks. "A big problem," said Mr. Phillips, "is obtaining money for cleaning sewers. When sewers are burried and out of sight, it is difficult to have the public or the public officials realize the need for spending money on them."

Regarding the matter of sewer cleaning, *G. J. Hoerbelt,* Mainte-

nance Engineer, Akron, Ohio, told of an unsolved problem in the outfall sewer where 20 in. of silt has hardened in the bottom. Men will not enter the sewer to work, and because of change in direction, it is not possible to set up a drag line and scrape the sewer. The Los Angeles County method of sending a floating baffle-dam "sewer-hoe" down the sewer was explained by Mr. Rawn. The water behind pushes the dam along, at the same time cutting under the baffle with sufficient velocity to cut away the sludge, silt or gravel deposits. In small sewers rubber beach balls are used for the same purpose. Mr. Brooks of Worcester, Mass., suggested keeping the sand out of the sewers by trapping catch basins. J. J. Woltmann, Consulting Engineer of Bloomington, Ill., explained how a 51 in. sewer three-quarters full of gravel was moved by jetting.

To the question by Suther LaRue, Engineer of Akron, Ohio, concerning the use of equipment to determine the presence of sewer gases, Mr. John H. Brooks, of Worcester, said that although the equipment was available, the men would not use it, and Mr. Van Kleeck, of the Connecticut Department of Health, said that approximately one out of forty cities in Connecticut had such equipment. In his own surveys throughout the State, Van Kleeck uses a test lamp for explosive gases and oxygen deficiency. Mr. Rawn said that the City of Los Angeles uses a distinctively painted small truck which makes tests systematically and constantly throughout the city to determine particularly the presence of oil or explosive gases.

Operators' Turntable

Reported by
George E. Symons, Buffalo, N. Y.

Following the Federation Breakfast Club, attended by a large number of early risers, the "Operators' Turntable" was again in session on the subject of **"The Significance and Value of Laboratory Tests in Sewage Plant Operation,"** under the leadership of LeRoy W. Van Kleeck, of the Connecticut State Department of Health. Six topics were scheduled, but because of lack of time, only four were covered.

On the subject of **"Sampling and Preservation of Samples,"** Mr. Van Kleeck introduced Don Bloodgood, Superintendent of Treatment, Indianapolis, Ind., who pointed out that sampling is complicated and important; complicated because it is difficult to do, and important because it is the representativeness of the samples which determines whether or not the results obtained in the laboratory are significant as far as plant operation is concerned. Samples may be collected continuously by automatic devices or at periodic intervals by hand sampling. Most general practice in sewage treatment plants is hourly collection of samples. The size of the sample should be proportionate to the flow at the particular time of sampling, and the samples should be picked from a location where there is sufficient agitation to insure that the sample is representative of the cross-section of flow.

In order that there be a minimum time of storage, Mr. Bloodgood prefers the use of the "fiscal" day, beginning at 8 a. m., and he likewise preferred daily sampling to three times a week—on Mondays, Wednesdays and Fridays only.

In regard to plant practice at Worcester, Mass., Roy Lanphaer, Superintendent, stated that hourly samples of 250 ml. size are collected and that although he believes hourly samples are good, they are not as good as continuous sampling. He believes in proportionate composites, although at Worcester the sample size is not exactly proportionate to the flow, but is approximately so.

In further discussion on the matter of sampling, *Dr. F. W. Mohlman* (Chicago Sanitary District) pointed out that in the case of industrial wastes, samples may of necessity be taken at 10 to 15 minute intervals and should *always* be proportional. Plant samples collected hourly or automatically and continuously both have their advantageous points. "The latter obtains proper frequency, but the amount taken at any particular instant is small and the sampler needs to be watched to prevent fouling," said Dr. Mohlman.

In reference to the preservation of hand-collected samples, Dr. Mohlman mentioned that Dr. Hatfield of Decatur, Ill., had reported decreases in uniced B.O.D. samples up to 30 or 40 per cent in 24 hours, while Dr. Rudolfs of the N. J. Agricultural Experiment Station, reported B.O.D.s increased considerably. Dr. Mohlman himself found changes of 3 to 5 per cent and believes that temperature is one of the main factors in the change, although other characteristics such as strength and composition likewise have a bearing. Samples with high B.O.D.s are not so greatly affected as are river samples, said Dr. Mohlman.

Dr. W. D. Hatfield, Superintendent, Sanitary District of Decatur, Ill., spoke on the controversy and reported that his original studies were prompted by comparison of hand-sampling versus automatic sampling, where the former was 10 per cent higher than the latter in the summer, but not in cold weather. On this basis he studied the relation between temperature and B.O.D. His results showed that uniced samples changed 30 per cent, whereas Mr. Kraus, of Peoria, reported 40 to 50 per cent changes. Dr. Hatfield believes the reason such drops are obtained in cities the size of Decatur and Peoria is that the sewage is received in fresher condition at the plant. In large cities, with longer interceptors, the drop has already occurred and therefore the B.O.D. concentration of the sewage received at the plant is, in reality, much less than actually existed in the sewage entering the interceptors. Dr. Hatfield believes that automatic sampling and hand sampling compare well when there is a constant flow, particularly if the hand samples are cross-sectional samples.

Dr. Clair N. Sawyer, of University of Wisconsin, introduced the subject of **"Bio-chemical Oxygen Demand and Dissolved Oxygen"** with the statement that it was nice to know that fortified dilution waters give results agreeing with the older bicarbonate water as shown by the work of Ruchhoft's Committee, but he raised the question as to what tests should be used to determine the value of dilution water. Stating that distilled water was often O.K., he questioned what happened when one added nutrient salts. Using Dr. Hatfield's system of checking dilution water by the variation between the individual dilutions with a limit of 5 per cent, Dr. Sawyer finds that for certain substances he obtains only 50 per cent of the calculated B.O.D. When samples of this organic sugar were sent to other laboratories for the determination of B.O.D., it was found that the results obtained were some 20 per cent higher than those that Dr. Sawyer obtained. Therefore, we need a primary standard, an organic substance which can be used by all laboratories as a means of determining whether or not the dilution water in use is giving the proper results. Dr. Sawyer also indicated his belief in the need for good seeding to obtain proper bio-chemical oxygen demand results. In the matter of the determination of dissolved oxygen, Dr. Sawyer believes that sodium azide should be used wherever necessary, but he does not believe it is always necessary.

F. Woodbury Jones, of Havens &

Emerson in Cleveland, raised the question as to the importance of B.O.D. accuracy, pointing out that B.O.D. was a tool to determine the relationship between raw sewage and final effluent, and that comparative results were all that were necessary. "What difference does it make whether the B.O.D. is 120 or 150, so long as you obtain necessary information on the operation of the plant?"

Mr. Van Kleeck called to attention the fact that not all treatment plants were actually interested in B.O.D. determinations, and he called on your humble servant—"the reporter"—to explain the attitude of the Buffalo plant. It was explained that the primary function of the Buffalo treatment works was to eliminate bacterial pollution from the Niagara River; secondarily, to remove suspended solids from the river. At no time even before sewage treatment was there an actual nuisance in the Niagara River because of deoxygenation. This is true because of the extremely high dilution afforded to Buffalo sewage discharge. The B.O.D. of the Niagara River before sewage treatment was less than 1 p.p.m. below the discharge of Buffalo sewage. Although the Buffalo plant determines the B.O.D. of the raw and effluent sewage, the data are of no particular or vital interest in the operation of the plant. Of far more importance is the information on the chlorine demand and residual chlorine and the coliform bacterial content of the raw sewage, and particularly of the final effluent.

Dr. C. C. Ruchhoft, Principal Stream Pollution Chemist of the U. S. Public Health Service, Cincinnati, Ohio, reminded the audience that sodium azide was not the only substance to use in place of the Rideal-Stewart modification of the Winkler method; sulfamic acid is available and effective.

Lyle Calkins, Chemist of the Toledo, Ohio, plant, reported that they sometimes obtained an industrial waste with a soluble B.O.D. of 400,000 to 750,000 p.p.m., and that they had used both formula C water and bicarbonate water, separately and combined.

The subject of **"Settleable Solids and Suspended Solids"** was introduced by Dr. Anthony J. Fischer, Development Engineer of The Dorr Co. Removal of suspended solids in clarification or sedimentation is an important function of primary treatment, but the results of such operation as determined in the laboratory are often affected by storage of the samples. Samples refrigerated below

Twin Engine and Blower Sets—Cleveland's Southerly Treatment Works
Gas for operating these Cooper-Bessemer driven Roots-Connersville blowers is derived from partial digestion of sludge originating at the Easterly plant, delivered through force main to the distant Southerly works for short period digestion, vacuum filtration and incineration in multiple-hearth rabbling type Nichols furnaces

4° C. show less flocculation or agglomeration of colloids than those stored at higher temperatures. Results as to removals are further affected by this agglomeration on storage by the fact that the colloids in the effluent often coagulate or flocculate to a greater extent than those in the raw sewage. Gooch suspended solids may not always be applicable and it has been found in some cases that the determination of suspended solids by the aluminum dish method, while giving better results than the Gooch, still are not always applicable.

Dr. Fischer prefers the determination of gravimetric settleable solids as indicating the efficiency of sedimentation tank operation. This efficiency of clarification or settling tank operation can be obtained by dividing the plant results by the laboratory results, i.e., the difference between the suspended solids in the influent and effluent divided by the weight of the settleable solids in the influent as determined by sedimentation in a container in the laboratory. A standard procedure for the gravimetric determination of settleable solids in sewage has been proposed, and although it has not been published, it is included in the revision copy for the new Standard Methods.

Confirming Dr. Fischer's statement, *T. C. Schaetzle,* Superintendent of the Akron, Ohio, sewage plant, said that he had found changes in suspended solids in twenty-four hours and even in six hours due to what he terms "autoflocculation." Furthermore, that this "auto-flocculation" differs in the raw sewage and the settling tank effluent. *Dr. Hatfield,* likewise, confirmed the observation that standing affects the suspended solids, but believes that the operator has no choice but to "take it and like it." In this regard, *Stewart Coburn,* Chief Chemist of Metcalf & Eddy, reiterated F. W. Jones' idea concerning B.O.D.s, namely, that comparative data are the important information desired, not ultra accuracy. Whereupon C. C. Larson, of Springfield, Ill., raised the question as to what had happened to Standard Methods, stating that a great deal of work had been and was being done on the preparation of the new Standard Methods. "It appears that many operators are either not interested in following the exact procedures or are developing procedures of their own, a condition to be deplored," said Larson.

W. W. Sanderson, of the New York State Department of Health Laboratories, introduced the subject of **"Relative Stability."** According to experimental data in the New York State Laboratories, some of the results which have apparently discredited the relative stability tests were due to the change in the dye

salts from one edition of Standard Methods to the next. Comparable results are not obtained with the use of the double zinc salt and U.S.P. salt because the former contains a less percentage of total methylene blue dye than the latter, and the latter is more bactericidal; likewise, the keeping qualities of the dye salts change. If the quantity of solution of methylene blue is kept the same for the two different salts, it is obvious that any difference in bactericidal effects and in the concentration of the actual dye will markedly affect the relative stability results.

Time did not permit going into "Grease," scheduled for discussion by Dr. George E. Symons, or the subject of "Use and Care of Laboratory Equipment," scheduled for Dr. W. D. Hatfield.

Business Session

President Arthur S. Bedell gave a tribute to Secretary W. H. (Pete) Wisely, to Dr. F. W. Mohlman, Editor, and to a "Working Vice-President," George Schroepfer. It was stated that work on the Selective Service classification of sewage plant operators was still going forward, although there had been no acceptance of the offer of the Sewage Works Federation representatives to appear in Washington to discuss the matter. Mr. Bedell pleaded that the home front be safeguarded and that key men should not leave their positions to join the military service. Mr. W. H. Wisely, Secretary of the Federation, reported that there were 2,391 members in the Affiliated Association, some 398 *less* than this time a year ago. The Associations of the Ohio Sewage Works Conference, the Florida Sewage Works Association and the New Jersey Sewage Works Association were received into membership in the Federation during the year.

Several committee reports were received and given in brief with the following salient points. The Research Committee is expanding its activities to report, by title, research problems which are under study throughout the nation during each year and also to bring to attention for study any research problems which are placed before the committee. The Sewage Works Practice Committee states that two chapters on the manual will be undertaken during the coming year—one on sludge fertilizer and the other on sewer maintenance. The Standard Methods Committee reports that a semi-final draft of the Standard Methods is now complete, lacking only two methods. Standard Methods will probably not be published for the duration, which means that changes in the present draft of Standard Methods may yet occur, within the next year at least.

The attendance cup for the Association whose members traveled the greatest man-mile distance was again awarded to the Central States group, whose 68 members traveled a computed 22,000-plus miles. As a fitting climax to the meeting, W. J. Orchard, Chairman of the Finance Committee, paid tribute to the work of the retiring president, Arthur S. Bedell.

Plant Inspection

With transportation provided by a committee headed by A. H. Niles, of Toledo, and guides including J. J. Wirts, Superintendent of the Easterly plant, F. W. Jones, William L. Havens, Matthew Braedich and Prof. George E. Barnes, a large number made the inspection trip of Cleveland's Easterly Sewage Treatment Works on Saturday afternoon. Luncheon was served in the cafeteria of the treatment works upon arrival, with a choice of steaks, ham, salad, potatoes and coffee, with pie for dessert. Comments on the cleanliness of the laboratory, attractiveness of the grounds, the clarity of the effluent, and the vast amount of aluminum in the plant were heard from many of the visitors.

Exhibitors

The following 27 firms, occupying 34 booths in the exhibit hall, were represented at the Cleveland Conference.

Aluminum Co. of America
American City Magazine
American Well Works
Builders-Providence, Inc.
Carter Co., Ralph B.
Chain Belt Co.
Chapman Valve Co.
Chicago Pump Co.
Dorr Company
Engineering News-Record
Flexible Sewer Rod Equipment Co.
General Electric Co.
Infilco, Inc.
Johns-Manville
Lakeside Engineering Corp.
Limestone Products Corp. of America
Link-Belt Co.
Nichols Eng. & Research Corp.
Pacific Flush-Tank Co.
Pittsbugh Equitable Meter Co.
Public Works Magazine
Royer Foundry Machine Co.
Sewage Works Engineering
Vapor Recovery Systems Co.
Wallace & Tiernan Co.
Water Works & Sewerage Magazine
Yecmans Brothers

"Doc" Taylor in U. S. Engineers

Uncle Sam Gains Good Captain—We Lose Valued Contributor

"Doc"

Our good friend and valued contributor of many monthly and interesting articles in past issues, D. R. Taylor, Supt. at Roanoke, Va., has "joined up" for the duration which means that he will not be permitted to continue producing the series of articles planned, which are later to be published as a "Superintendents' Handbook." The article announced as next in this series—"The Hardy Cross Method Simplified"—although in our hands before he entered the service, is being postponed until its status is cleared.

"Doc," granted leave by the City of Roanoke, Va., is now a Captain of U. S. Engineers and located at the Atlanta, Ga., headquarters of the 4th Command Area. His job now, as we understand it, is that of water supply offices for the 4th Command Area which embraces the states of North Carolina, South Carolina, Georgia, Florida, Alabama and Tennessee.

Substitution in Another Form

Recently we came across a suggestion which strikes us as highly appropriate in these days of "making things do."

This suggestion, which should become a slogan for the duration, reads—

Make Things Do—

by substituting *"wear and care"* in the thinking of today for the more familiar *"wear and tear."*

BUY WAR BONDS AND SAVINGS STAMPS

WAR TIME WATER CONFERENCE OF THREE ASSOCIATIONS

Four States and New Jersey Sections of A.W.W.A. and Penna. Water Works Operators' Assn. Meet Jointly to Discuss War Problems

By HARRY A. FABER*
ASSOCIATE EDITOR

MORE than 340 members of three water works groups met in a Regional War Time Conference at Philadelphia on October 7, 8, and 9, 1942. Sponsored by the Four States and New Jersey Sections of the A.W.W.A. and by the Pennsylvania Water Works Operators' Association, this joint meeting provided a valuable opportunity for water works men to keep up to date on the latest technical and administrative developments.

Chairmen—Four States Section

(Incoming) *J. G. Patrick, Chemist, West Va. Pulp & Paper Co., Luke, Md.*

(Retiring) *Carl A. Hechmer, Engr., Washington Sub. San. Dist., Hyattsville, Md.*

The conference included a banquet but entertainment was eliminated, in line with the businesslike concentration which prevailed throughout. On the evening preceding the conference, a friendly get-together permitted early arrivals to meet old friends and to make new ones.

Following the last sessions on Friday morning, many members made the trip (by train, bus, or automobile) to the Belmont Filter Plant of Philadelphia. There an inspection trip was arranged through the laboratories and to both the slow sand and rapid sand units of the plant.

For a technical program of outstanding calibre, H. Lloyd Nelson, Philadelphia, Chairman, and his committee deserve special credit. The committee consisted of: R. C. Beckett, Delaware; H. P. Croft, New Jersey; G. L. Hall, Maryland; and H. E. Moses, Pennsylvania. Chairmen of the three technical sessions were drawn from the three groups participating: Wm. F. Ayars, New Jersey section; Carl A. Hechmer, Four States section, and Harry J. Krum, Pennsylvania Association.

A business meeting of the Four States section was held to elect officers for the coming year. Those appointed are:

Four States Section Elects New Officers

Chairman

J. G. Patrick, Chemist, West Virginia Pulp and Paper Co., Luke, Md.

Vice-Chairman

Wm. R. Schnabel, Supt. and Engr., Allentown, Pa.

Secretary-Treasurer

H. Lloyd Nelson, Eastern Sales Mgr., U. S. Pipe & Foundry Co., Philadelphia, Pa.

Trustees

Harry R. Hall, Chief Engr., Washington Suburban San. Dist., Hyattsville, Md.

H. E. Moses, Chief Engr., State Dept. Health, Harrisburg, Pa.

Executive Committee Members

Wm. F. Ayars Chmn. N. J. Sec., Supt. Water Dept., Salem, N. J.

Harry J. Krum Pres. Pa. W.W. Op. Assn., City Chemist Allentown, Pa.

Seth M. Van Loan Receives the Fuller Award

At the banquet on the last night of the meeting, the Fulton Award recipient for the Four States Section was announced, and three past-presidents of the A.W.W.A. gave short talks of timely significance. The Fuller Award was presented to Seth M. Van Loan, Engineer in Charge of Water Works Improvement, Philadelphia, in recognition of over forty years of service in the advancement of the water works profession. In addition to his functions as chairman and director of the Four States Section in the past, Mr. Van Loan has served on a number of A.W.W.A. committees. He accepted the award as bearing a special significance because of his former association with George W. Fuller in several studies and technical reports.

New Trustees

Harry R. Hall Chief Engineer Wash. San. Dist. Hyattsville, Md.

H. E. Moses Chief Engineer State Dept. Health Harrisburg, Pa.

W. W. Brush, Editor, Water Works Engineering, New York, commented on the present difficulties which complicate inventory maintenance. While not criticizing the limits set up by WPB for repair materials, he recognized that it would not be simple to make some items stretch and meet present heavier demands upon systems.

Harry E. Jordan, Secretary, A.W.W.A., New York, discussed the ever-more-serious problem of man power and suggested certain solutions. Major losses of personnel from water

*Research chemist, The Chlorine Institute, Inc., New York, N. Y.

Reeves Newsom
Past Prs. A.W.W.A.
Engr.-Consultant
New York, N. Y.

Rennie Dodd
Executive Manager
Municipal Author.,
Chester, Pa.

utilities, he said, were not due to selective service, but to voluntary withdrawal of men who entered other fields of employment. There are indications that regulation of employment by a Federal Agency may be essential in order to maintain uninterrupted operations of production such as in utilities. Employment of women, of less suitable men, and of young people in such fields will apparently be essential.

Reeves Newson, Engineer-Consultant, New York, mentioned that certain areas such as Newport News and Norfolk, Virginia, must be regarded as super-critical with reference to water supply problems. Of about 200 critical areas in this country, there are some 25 to 30 which fall into the super-critical class. At Newport News, for example, the tremendous growth of shipyard employees and the increase in military population has created unprecedented demands upon the water utility. In 1939 consumption was 12 to 13 mgd. and an increase in capacity of 6 mgd. was first planned. This was subsequently enlarged to a total of 30 mgd. and it is recognized that still further increase will be required.

The banquet was concluded with the showing of a motion picture depicting the advantages of attending the A.W.W.A. Chicago War Time Conference. This was prepared and presented by the Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., and constituted a full-color report on the convention activities of the Association.

Technical Papers

Round Table on Water Conservation

"Water Conservation—A Round Table Discussion," by:

James H. Allen, Chief Engineer, Interstate Commission on the Delaware River Basin.

R. C. Beckett, State Sanitary Engineer, Dover, Delaware.

H. T. Critchlow, Chief Engineer, New Jersey State Water Policy Commission, Trenton, N. J.

R. I. Dodd, Executive Manager, Municipal Authority, Chester, Pa.

M. J. McLaughlin, Chief, Bureau of Water, Philadelphia, Pa.

G. J. Requardt, Cons. Engr., Whitman, Requardt & Smith, Baltimore, Md.

Mr. Allen described the serious situation existing in the Philadelphia Metropolitan Area, where two and a half million people must be assured a safe water supply at all times for both war and civilian needs. By asking questions of the round table members, he made clearly evident the preparations and accomplishments of the Philadelphia, Delaware, and New Jersey areas for the summer just past.

Mr. Allen: The problem resulted from three factors: 1. The tremendous expansion of war industries. 2. The accelerated spread of defense housing and war housing developments. 3. The abnormal increase in home consumption caused by increased employment and by population growth. Raw water is abundant, but the purification systems of the city of Philadelphia, of the Suburban water Company, and of the Chester Municipal Authority Water Service were not designed to meet such abnormal demands. Increase in capacity of treatment plants was out of the question, because of prior demands for materials and labor. The problem had only one answer: water conservation.

Mr. McLaughlin: Philadelphia had underway a 2.5 million dollar water system rehabilitation program, but

Program Chmn.
H. L. Nelson
Eastern Sales Mgr.
U.S. Pipe & Fdy. Co.
Philadelphia, Pa.

Round Tabler
G. J. Requardt
Cons. Engr., Whitman, Requardt & Smith,
Baltimore, Md.

was not equipped to meet abnormal war time demands. Before Pearl Harbor, the average summer time demand was 335 mgd. and the maximum at times was 400 mgd., which is approximately the capacity of the system. Early in 1942 consumption had increased 10 per cent above the corresponding months of 1941.

Mr. Dodd: The same fundamental problem confronted the city of Chester, adjoining Philadelphia. Except as to filtration plant facilities, that system was adequate and in good condition. In 1941 the filtration plant had a reserve capacity of 20%, but only a little arithmetic was required to show that this reserve would soon be wiped out.

Mr. Critchlow: While the Philadelphia Suburban Water Company serves a large residential area, it has a number of large industrial communities to serve as well. Because the demands of these consumers have increased substantially, this company has equally difficult water conservation problems. Only by some method of reducing demands due to wastage and non-essential uses could the situation be met.

Mr. McLaughlin: It was through the efforts of Incodel (Interstate Commission on the Delaware River Basin) that the water supply agencies were brought together. The details and policy for public conservation were arranged through its guidance.

Mr. Dodd: The appeal was carried

(1) George C. Schout, Chief Chemist, Bureau of Water, Belmont Filter Plant, Philadelphia. (2) J. R. Harvey, Asst. Engr., State Dept. Health, Philadelphia. (3) R. Heister, Reading Bureau of Water, Reading, Pa. (4) S. R. Pearson, Chief Operator, Sewage Treatment Plant, Conshohocken, Pa. (Pres. S.E.S.W. Operators' Assn.) (5) T. H. Story, Chem. Engr., Ozone Processes, Inc., Philadelphia. (6) Thomas Kinslow, River Patrol, Bureau of Water, Philadelphia. (7) W. B. Johnson, Supervisor, Bureau of Water, Easton, Pa.

out by a concentrated campaign using the press, radio, civic organizations, and civilian defense agencies. Plain facts were presented and methods of cooperation were outlined. Use water really needed, but no more. Repair promptly leaking plumbing fixtures. Curtail garden and lawn sprinkling. Develop and practice the habit of water-watchfulness.

Mr. McLaughlin: Cooperation of civic organizations, newspapers, and radio was thorough and efficient. Industrial waste was recognized as equally important and employees were ordered to repair leaks and to practice conservation.

Mr. Beckett: The results were most encouraging, showing that the vast majority of the water consumers in the District responded patriotically. It had been estimated that the demands in Philadelphia would be at least 40 mgd. above normal during this summer.

Mr. Allen: Actually the city met the increased demand for essential needs, but found water consumption to be 20 mgd. less than was used during the previous summer.

Mr. Dodd: Chester used, during the peak period of demand about 15% less water than during 1941. Without conservation, an increase at least 20% could have been predicted.

Mr. Critchlow: New Jersey has promulgated a State Emergency Water Supply Act to assure an uninterrupted supply of water to communities in which war industries are located. A program of interconnections provides emergency supplies against failure of either system so connected, and enables the transfer of water from a system which may have a surplus to one which may have a shortage, in order to conserve water for future use. Seventeen such interconnections have been ordered to date. In addition, a plan has been set up for the joint operation of certain public water supply systems in metropolitan areas. This will provide a supply of water in the northeastern district of New Jersey to areas which may have their source of supply cut off through sabotage, bombing, or from any other cause.

(1) *John N. Brooks and* (2) *H. T. Critchlow, Chief Engineer, N. J. State Water Policy Comm., Trenton, N. J.* (3) *George H. Bone, Chief Operator, Sewage Treatment Plant, Norristown, Pa., and* (4) *Eugene B. Swinehart, Chief Operator, Boro Sewage Disposal Plant, Pottstown, Pa.*

Effective maintenance and operation of water systems is essential since they constitute the one basic utility guarding the health, safety and welfare of every citizen.

"Water Works in the War Production Board," by Arthur E. Gorman, Chief, Water Production Section, Power Branch, WPB, Washington, D. C.

Mr. Gorman called for full co-operation of all water works men to meet the unprecedented demands of the war production program. He elaborated upon the facts set forth in his paper, "Water—A Critical War Material," as published in the October 1942 issue of WATER WORKS AND SEWERAGE.

All water works systems should immedately develop plans to eliminate the large seasonal load typical of summer consumption. These plans should function in the summer of 1943, since no normal expansion of systems can be made because of the lack of critical materials.

The efforts of the WPB have been materially aided by the work of Secretary Harry E. Jordan and of President Abel Wolman of the A.W.W.A. To get water to essential consumers and to maintain water systems at standards adequate to meet the war effort, are the functions of the Water Production Section. Mr. Gorman advised that careful and complete preparation of details on projects submitted for approval would receive more prompt action than would a personal visit to Washington.

Mr. Paul Valle, a member of the WPB staff, explained delay of the new P-46 Order as due to difficulties in equitably assigning critical materials. He answered questions regarding trade of excess stock items under the mutual aid plan, saying that the WPB will aid in such transactions.

"Reduction of Excess Inventory Through Mutual Aid Plans," by John H. Murdock, Jr., President, The Pennsylvania Water Works Association, and State Water Coordinator for Pennsylvania.

According to Mr. Murdock, evidence proves that water works men are entirely willing and anxious to cooperate in the war effort. They are faced by a real problem in fulfilling rules and regulations, however, especially in the smaller organizations.

Not only will it be impossible to undertake new work, but even ordinary maintenance operations will become increasingly difficult. Materials are inadequate, and labor will present a serious handicap. The maintenance of good public relations under such conditions will be no simple matter but it must be solved.

The Harrisburg office of the State Water Coordinator will act as intermediary in transferring reserve water works materials and equipment between municipalities. In order to carry out this mutual aid plan, the Pennsylvania Water Works Associations were asked by Mr. Murdock to appoint representatives to form a committee. The function of the committee will be to design the

(1) *Geo. S. Levering, Dist. Engr., and* (2) *Wm. J. Thompson, Supt. Queens Lane Filtration Plant, Philadelphia.* (3) *Harry Smith, Plant Supt., and* (4) *R. S. Waters, Genl. Supt., Bureau of Water, Philadelphia.* (5) *Samuel Cirelli, Asst. Supt., and* (6) *Sam Crawford, River Patrol, Bureau of Water, Philadelphia.* (7) *Charles G. Bourgin, Asst. Supt., Bureau of Water Supply, Montclair, N. J., and* (8) *Wm. R. Schnabel, Supt. and Engr., Bureau of Water, Allentown, Pa.* (9) *Elwood L. Becn, Chemist, and* (10) *Walter Ringer, Asst. Chemist, Bureau of Water, Philadelphia.*

mechanism suitable for creating an inventory and means for exchanging needed materials.

"Emergency Experiences in 1942 Flash Floods," by Bernard S. Bush and M. J. Barrick, District Engineers, Pennsylvania State Department of Health.

Unlike previous floods in this section, the flash floods of 1942 descended as devastating walls of water —without warning and with terrific velocities. There were four such floods in Pennsylvania this year, the first two leaving in their wake a large toll of death and devastation. They also wrecked havoc with water supplies, leaving numerous communities without any water supply whatever for periods as long as twelve days.

Upon receipt of flood reports, the Governor's Emergency Disaster Committee promptly dispatched personnel from various state departments, together with sanitation and medical supplies, so that facilities were provided for aid even before recession of the flood waters. Health Department engineers devoted their efforts first to safeguarding emergency water supplies, next to aid in restoration of damaged supplies, and finally to carry out general preventive sanitation.

This experience provided a test of the water works defense preparations to act as a unit under district chairmen. Considerable such organization of this nature has been effected, but the laxity of a few local officials prevented the immediate reference to inventories of equipment. Some excellent defense emergency equipment was covered by the flood waters or by tons of debris.

Equipment supplied for disinfection of water mains included trailer type chlorinator type units, portable direct feed chlorinators, and hypochlorinators. This special equipment was furnished by Wallace and Tiernan Company, whose representatives remained to install and operate the equipment. Hand pumps to feed hypochlorite solution to lines under pressure, and emergency apparatus feeding chlorine gas direct from tank to main, were supplied by the Scranton-Spring Brook Water Service Company. In addition to these emergency devices, use was made of existing standard chlorination equipment and of barrel hypochlorite feed devices.

Contaminated sections of mains and all new pipe lines were disinfected as rapidly as they were repaired or replaced. Water from all sources was chlorinated to insure the presence of 0.2 ppm. residual or higher throughout distribution systems. The treatment was found, by bacteriological analysis, to provide a safe water. The authors recognized certain weaknesses in water works defense preparations, but found the availability of trained emergency personnel to be of great advantage.

At the Belmont Filtration Plant:

(1) Inspecting equipment in the experimental filtration laboratory. (2) Filter operators serve beer and pretzels at the "open house." (3) Chief Chemist Schout explains operations of the laboratory.

"Determination of High Chlorine Residuals," by A. E. Griffin, Asst. Director, and N. S. Chamberlin, Technical Service Divison, Wallace and Tiernan Co., Inc., Newark, N. J.

Mr. Griffin pointed out that, until recently, water works personnel has been little concerned with the exact measurement of high chlorine residuals. But emergency conditions require a reliable, rapid, and simple field method of determining high residuals such as may be demanded for disinfection of repaired mains. Ortho-tolidin is ideally suited for this work.

Some years ago, those reporting research on ortho-tolidin reactions noted that when insufficient ortho-tolidin is added, the color produced is too red. While this condition has been recognized, little emphasis has been placed upon it. Research shows the usual yellow color indicates ortho-tolidin to be present in excess of the chlorine, and accurately measures the chlorine concentration. The red color indicates only that chlorine is present in excess of the ortho-tolidin. Study of the reaction proves that 3.0 parts of ortho-tolidin must be supplied for each 1.0 part of chlorine in order to insure production of the desired yellow color.

In the method recommended by the authors, the standard volume of ortho-tolidin is added to chlorine free water and the ratio of ortho-tolidin to chlorine of 3 to 1 is maintained by limiting the concentration of chlorine water added. Existing color standards, either of the 100 ml. or of the comparator type may be employed in this method providing the yellow color developed is restricted to 1.0 ppm. or lower.

In practice, the high chlorine content water is added by means of a "medicine dropper" pipette. Most droppers deliver water at the rate of approximately 20 drops per ml., and such a dropper must be selected. The procedure suggests the title "Drop Dilution Method" for this purpose. Using a standard chlorine comparator:

1. Place 15 ml. of zero chlorine demand water in the comparator tube and add 0.5 ml. of ortho-tolidin solution.

2. Add the water having a high chlorine content drop by drop until a yellow color, suitable for comparison with the color standards, is developed.

3. Calculate the strength of the unknown chlorine water according to the formula: Residual chlorine of original sample in ppm. =

$$\frac{300 \times \text{ppm. chlorine found}}{\text{number drops sample added}}$$

The procedure using 100 ml. permanent chlorine standards is similar except that 100 ml. of zero chlorine demand water and 1.0 ml. of ortho-tolidin are used. Strength of the unknown chlorine water is calculated in the same manner, substituting 2000 for the 300 in the above formula.

While Mr. Griffin presented this paper, Mr. Chamberlin demonstrated the important points by producing the reactions referred to—on an exceptionally large scale, visible to all the audience—and thus provided a most understandable demonstration. It is to be hoped that this paper will be made available in full because of its extremely practical and timely significance.

BUY

WAR BONDS

Snapped During

A.W.W.A.'S WARTIME CONFERENCE

Some Who Took Part in the Program and Some Who Came to Hear

Speakers

(1)—*Chas. B. Burdick, Consulting Engr., Alvord, Burdick & Howson, Chicago*

(2)—*Kenneth K. King, Director of Water Kansas City, Mo.*

(3)—*O. E. Meinzer, Chief, Ground Water Div., U.S.G.S., Washington*

(4)—*H. H. Potter, State Water Coordinator Maine Utilities Commission, Augusta, Me.*

(5)—*Lloyd M. Rebsamen, Mgr. of Water, Light and Sewerage, Jonesboro, Ark.*

IT IS with considerable regret and humble apologies to those whose pictures appear on these two pages that it proved impossible to run these cuts with installments of the report covering the Wartime Conference of A.W.W.A. held in Chicago, June 21st-25th. Herewith, the explanation.

Our regular readers will recall that we announced that we felt it of the greatest value to the greatest number to give over the space in our July issue, normally to have been used in printing the first installment of the report covering the Chicago Conference, to the important and timely address of Jas. H. Krug, Power Branch Chief of the War Production Board, and that of the incoming president of the Association Abel Wolman. While we

Speakers

(1)—*Frank J. McDonough, Mech. Engr. Dept. of Public Works, Chicago*

(2)— ——— *Walker, Attorney Chicago Bridge & Iron Co., Chicago*

(3)—*Arthur P. Kuranz, Supt. Water Dept., Waukesha, Wis.*

(4)—*Thos T. Quigley, Mgr., Priorities Dept. W. & T. Co., Newark, N. J.*

(5)—*Joseph P. Schwada, City Engr., Milwaukee, Wis.*

continue to feel that this space was put to the higher use by postponing the customary reporting of the Annual Meeting, we find ourselves embarrassed because of the inability to cover all of the technical sessions in those installments of the report which we have been able to run since.

We feel a bit piqued, too, in be-

(1) (2) (3) (4) (5)

(1)—*Edgar W. Johnson, Asst. Engr.*
J. Arthur Jensen, Engr. & Supt.
John A. Johnson, Retired Employee
Minneapolis Water Dept.

(2)—*J. Wm. Hill, Secretary*
Vic. E. Arnold, President
Wm. H. Johnson, Sales Mgr.
Phoenix Meter Co., New York

(3)—*Harry Draves, Supt., Michigan City, Ind.*
Walter Shea, State San. Engr., Providence, R. I.
H. A. Moffett, Ind. Chem. Sales, Detroit
"Stan" Kappe, Chicago Pump Co., Philadelphia, Pa.

(4)—*J. G. Bailey, Washington, Ind.*
S. H. Petrie, Toledo, Ohio
Arthur Crooke, Los Angeles
Representatives, Phoenix Meter Co.

(5)—*Buffalo Contingent*
H. W. Fitzgerald, Chief Engr., Water Dept.
"Bill" Fenger, Dist. Mgr., Mathieson Alkali
Newell Nussbaumer, Commissioner Public Works
*"Ken" Keirn, San Francisco Mgr. for W. & T. C.**
Alan Drake, Director of Water
**Formerly W.&T.'s Buffalo District Mgr.*

(1) (2) (3) (4) (5)

(1)—*"Jim" Barker, West Coast Manager Neptune Meter Co., San Francisco*
Alex Lindsay, Supt. of Water Spokane, Wash.
(2)—*A. P. Gumlick, President Water Board of Denver, Colo.*
D. D. Gross, Chief Engineer Denver Water Commission

(3)—*E. Scranton Gillette, V. P. & Gen'l Mgr. Gillette Publications, Chicago*
Jas. M. Angell, Eastern Mgr. Gillette Publications, New York
Jas. M. Angell, Mgr. Rochester, Ind.
Clarence Adams, Plant Supt. Ind. Public Service Co., New Albany, Ind.

(4)—*John H. O'Neill, Chief Frank W. McDonald, Associate La. State Sanitary Engrs., New Orleans*

(1)—*M. F. Hoffman, Commercial Supt. Water Dept., Cincinnati, O.*

(2)—*Edgar Hayman, President Michael Hayman & Co., Buffalo, N. Y.*

(3)—*Dan M. Flick, Vice-Pres. Armour & Co., Chicago*

(4)—*H. Cable Cramer, Manager Catlettsburg (Ky.) Water Co.*

(5)—*Joseph E. Young, Manager Dept. of Water and Light, Fergus Falls, Minn.*

H. P. Connell, Gen'l Mgr. Baton Rouge (La.) Water Co.

N. T. Veatch, Jr., Consulting Engr. Black & Veatch Engrs., Kansas City, Mo.

L. C. Eldridge, Chief Engr. Baton Rouge (La.) Water Co. (Director of A.W.W.A.)

ing accused by some of those who were snapped during the Conference, but whose pictures have not yet appeared in print, of not having any film in the camera when the job was done—and, from others similar jibes.

To prove that we did have film (and good film too), and to release the precious copper plated tied up in these cuts, we are running the balance of them without the customary accompanying coverage of papers and discussion. In doing so it is our hope that all who found themselves "exposed" to a certain cameraman, who boasts a considerable amount of luck in the general run of snapshooting conventioneers, will see the results which prove that there was at least some sort of film behind the 35mm. mirrowing sponse

George Pray, Manager of Utilities, Fort Dodge, Iowa

R. C. Bardwell, Supt. Water Supply, C. & O. Ry. System, Richmond, Va.

B. W. Cullen, Supt. Water Pipe Extension, Dept. Public Works, Chicago

of Sounar 1.5 lens, which helps make up the 3 lbs. of wrist testing Coutax-III, lugged about for a purpose.

(1)—*Fred J. Reny, Gen'l. Mgr. Portland (Me.) Water District*

(2)—*"Al" Brumley, Vice-Pres. Stuart-Brumley Corp., Baltimore, Md.*

(3)—*Daniel M. Sullivan, Deputy Chief Dept. of Public Works, Boston*

(4)—*Harry J. Draves, Supt. of Water Michigan City, Ind.*

(5)—*Sidney S. Anthony, Supt. of Water Augusta, Me.*
(Editor, Maine Water Utilities Ass'n)

BACTERIOLOGICAL RESULTS OF BREAK-POINT CHLORINATION

Some Observations at Fredericksburg, Virginia

By ALBERT E. WILSON, JR.*
Supt. of Filtration
FREDERICKSBURG, VA.

PRIOR to the enlargement of the Fredericksburg Filtration Plant in 1939 no chlorine was fed in the raw water. In May, 1939, the new 6 m.g.d. plant with facilities for prechlorination was put into operation. Ammonia was fed prior to the chlorine at different ratios varying from 1:3 to 1:10, the average being 1:4.5. At no time was the raw water chlorine dosage over one part per million and averaged 0.52 ppm. in the year 1940. The chloramine residuals in the settled water varied from 0.35 to 0.10 ppm. during this period. It has been the experience of the writer that higher chloramine residuals are necessary for constant sterilization and to prevent bacterial growths in the basins and filter beds during the summer months.

Some bacteriological results for the year 1940 will be cited as this is the first full year that prechlorination and preammoniation were practiced at Fredericksburg. Table 1 shows the most probable numbers coli-aerogenes bacteria in the raw and settled water for the year 1940. It will be noticed that the number of bacteria in the settled water was far above the average during the summer and early fall. The ammonia treatment was discontinued in the latter part of November, 1940, and straight prechlorination has been used ever since then. Much better results were obtained without the use of ammonia as shown in Table 2, which gives the M. P. N. of Coli-aerogenes for the year 1941.

During the early months of 1941 the chlorine demand of the raw water was low and the dosage was sufficient to give a residual of 0.25 ppm. in the settled water. This was break-point chlorination, as shown by the flash test with orthotolidin. The color develops immediately if the break point has been reached, whereas it takes as long as half an hour for the color to develop at low temperatures if chloramines are present.

*Since this article was written the author has entered war service as Assistant Sanitary Engineer, Public Utilities Dept., 3rd Corps Area, with headquarters in Baltimore, Md.

The Author

Table 1

M.P.N., Coli-aerogenes, Year 1940

	Raw Water	Settled Water	% Reduction
January ...	33	7.0	78.8
February ..	180	2.4	98.7
March	970	3.2	99.7
April	330	0.36	99.9
May	125	0.83	99.3
June	600	8.0	98.7
July	1270	18.5	98.5
August	1110	75.0	93.3
September .	950	24.0	97.5
October ...	470	8.9	98.1
November ..	1290	7.4	99.4
December ..	1550	5.3	99.7
Average .	740	13.4	98.2

Table 2

M.P.N., Coli-aerogenes, Year 1941

	Raw Water	Settled Water	% Reduction
January ...	400	2.3	99.4
February ..	295	2.1	99.4
March	265	0.45	99.8
April	205	0.28	99.8
May	100	0.00	100.0
June	470	0.24	99.9
July	380	0.00	100.0
August	300	1.1	99.6
September .	100	0.00	100.0
October ...	195	0.00	100.0
November .	125	0.25	99.8
December .	470	0.87	99.8
Average .	275	0.64	99.8

Table 3

M.P.N., Coli-aerogenes, Jan.-April, 1942

	Raw Water	Settled Water	% Reduction
January ...	630	0.00	100.0
February ..	780	0.00	100.0
March	780	0.00	100.0
April	725	0.00	100.0

Experience with Super Chlorination

The writer took over the operation of the plant in April, 1941. Not long after, with the coming of warmer weather, the chlorine demand increased and the chlorine dosage was stepped up to 9 P.M.G. (pounds per million gallons), representing the capacity of the raw water chlorinator at that time. The chlorine residuals gradually fell off to a low of 0.13 ppm. in June. It was felt by the writer that if a sufficient chlorine residual could be maintained in the water after reaching the filters, the bacterial density could be greatly reduced, especially during the summer months when most of the high concentrations of Coli-aerogenes have prevailed.

Break-point chlorination tests were run in the laboratory. These showed that the break-point would be at about 1.2 ppm. The chlorine dosage was increased to 1.7 ppm. about the middle of July. This dosage gave a residual of 0.4 to 0.5 ppm. in the water coming to the filters. This amount has been fairly constant throughout the fall and winter. The break-point chlorine dosage was much lower the past winter than it was in the summer of 1941. In February, for instance, the break came at a dosage of only 0.6 ppm.

The M. P. N. Coli-aerogenes was reduced from an average of 13.4 to 0.64 per 100 ml. in 1941, this being 95.2 per cent lower than the 1940 figure. However, the bacterial density of the raw water in 1941 was less than half that of 1940. This was due to the long periods of drouth in 1941 when there was no run-off and consequently no periods of high pollution.

The Effect of pH on the Process

A glance at Table 2 will show that better results were obtained during the last six months of 1941 when

there was a much higher chlorine residual in the settled water. In the months of July, September and October there was a complete absence of gas formers in the portions tested. In September and October the pH of the settled water varied from 6.3 to 6.5, which is optimum for the break-point reaction to go to completion. However, in July the average pH was 6.0 and on many days was much lower. Complete sterilization was not expected at these low pHs because of the time element. Apparently, the lower the pH the slower the oxidation takes place. The temperature of the water may be a factor in the break-point reaction and it may go to completion in warm waters even at pH around 6.0. The average temperature for July was 81 degrees F.

Nothing of particular importance happened during the next four months. Then in the second week of December gas formers began to appear in the settled water almost daily. They fermented B. G. B. broth and confirmed as B. coli on E. M. B. plates. Incidentally, 5-10 ml. portions are planted originally in the lactose broth. The chlorine residuals were unchanged, being between 0.4 and 0.5 ppm. The pH of the settled water dropped off from 6.5 to 6.1 on Dec. 9 and went on down to 5.9 a few days later. The raw water temperature was between 35 and 40 degrees F. and the floc formation was none too good at these low temperatures. On Dec. 18 it was found in the laboratory that a better floc could be obtained if lime were added to the raw water prior to coagulation. This naturally brought about an increase in the pH of the settled water. It went up to 6.3 the first day of the lime treatment and since then has been as high as 6.7.

Simultaneously with the pH increase, the gas formation in the lactose broth tubes ended as suddenly as it began. Evidently the break-point reaction was now going to completion at the higher pH.

During January and February the raw water temperatures were even lower than in December, being only a few degrees above freezing.

Table 3 gives our bacterial data from January, 1942, up to this writing—through April, 1942. There have been no confirmations in the settled water during this time despite increased pollution of the raw water. The majority of the lactose broth tubes have remained clear after the usual 48 hour incubation period, showing that little or no bacterial growth was taking place. What the results would have been had not the pH been raised in the settled water can only be assumed. Future work in the laboratory will consist of bacterial tests on water flocced at varying pHs, the chlorine dose and the contact time remaining constant. We have a Phipps and Bird laboratory mixer with a r.p.m. indicator which gives uniform mixing and stirring comparable to plant conditions.

The facts in our experience with break-point chlorination seem to further confirm the belief that the break-point reaction is slow and incomplete in the lower pH range. Coli form organisms continued to live in waters of low pH but died when the pH was raised. Why there were no gas formers during the month of July, 1941, is a question that can be answered only after more experimental data can be obtained. The pH values were lower than in December. The lone variable was the temperature of the water.

An Important Result

One final but important result of break-point chlorination has been the greatly increased stability of chlorine residuals leaving the plant. We have a two million gallon open reservoir about one-half mile from the plant. Last summer before chlorinating to the break-point we could not carry any residual chlorine in the reservoir with a 0.30 ppm. residual leaving the plant. There is now (April 18) a residual of 0.08 ppm. at the reservoir. We can also maintain a chlorine residual much farther in the distribution system than heretofore. These results concur with those of Harvill, Morgan and Mauzy at Houston, Texas.*

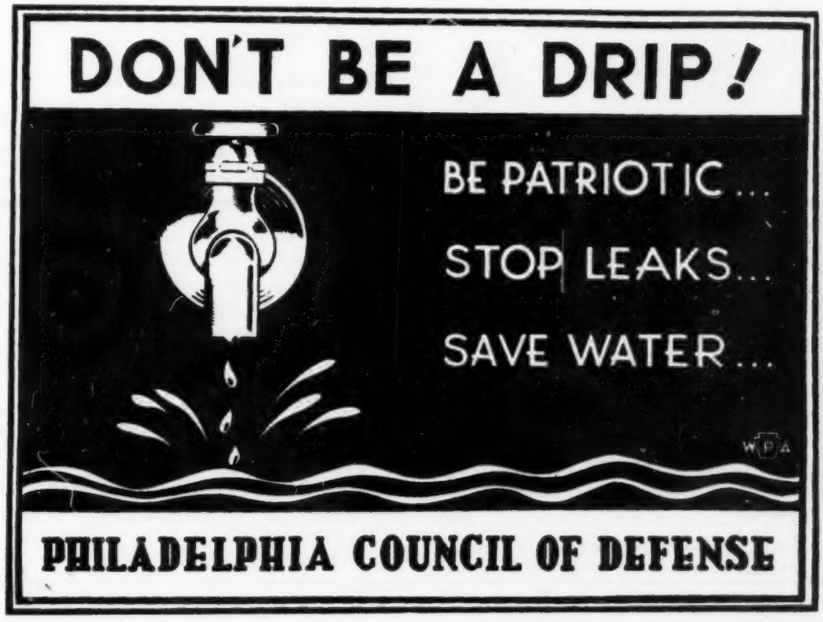
*Practical Application of Ammonia-Induced Break-Point Chlorination—Clyde R. Harvill, J. H. Morgan, and H. L. Mauzy. J.A.W.W.A. 34:275 (February, 1942).

"Don't Be a Drip!"

The interesting poster here pictured was one of a number of various designs used by the Philadelphia Bureau of Water in its Water Conservation Campaign. It seemed to us to be the most catchy of the themes and designs used to make the Philadelphia public water waste conscious to the extent of having dripping and dribbling plumbing fixtures put in condition.

In addition to the educational program, involving the use of leaflets, posters, window display cards, the campaign included pressure reduction during night hours, contamination of water waste surveys that have resulted in correction of many important leaks on the distribution system, house to house leak inspections, radio and newspaper appeals to the public.

The Philadelphia campaign has been quite successful in curtailing waste, particularly the leakage surveys on the distribution system.



THE DETERMINATION OF HIGH CHLORINE RESIDUALS

A Discussion of the Chemistry of the Ortho-Tolidin Reactions Involved Therein

By N. S. CHAMBERLIN
Sanitary Chemist
TECHNICAL SERVICE DIVISION
WALLACE AND TIERNAN CO., Inc.
Newark, N. J.

EMERGENCY disinfection practice, which involves carrying high chlorine residuals in the water in the mains being sterilized, once again brings to the attention of the water works profession the lack of a quick and accurate colorimetric method for determining high chlorine residuals. It is a challenge to the water works profession.

This is not a subject that can be dismissed by placing reliance on a volumetric method of analysis. Such a method has no place in the field, for there it becomes both a cumbersome and impractical procedure. Likewise, it is a subject which can not be dismissed by placing trust on the red color produced by the action of ortho-tolidin on water containing a considerable quantity of free chlorine. Close observation of a test carried out along the lines of the present *standard methods of water analysis* (1) for chlorine residual of 1 p.p.m. or less would reveal that the red color produced by a water containing 10 p.p.m. chlorine is no lighter than the red color produced by a water containing more than 10 p.p.m. chlorine, say 25 p.p.m., 50 p.p.m., or more. From this one would conclude that the red color is not indicative of the magnitude of the high chlorine residuals. Actually, the red color in this instance is only indicative of the amount of ortho-tolidin present; and there certainly is no desire on the part of the analyst to determine the amount of reagent added in the test.

The Author

Since the red color cannot be used as a quantitative measurement of the free chlorine present in the water, a fact which has not been clearly understood, a review of the reactions of O-T (ortho-tolidin) with chlorine should clarify the situation. From such an undertaking it may be possible to arrive at the proper set of conditions for the quantitative measurement of high chlorine residuals. An understanding of three of these reactions and their reacting environment is very enlightening, so much so that the methods of determining high chlorine residuals quantitatively by means of O-T immediately become evident.

Three Important Reactions

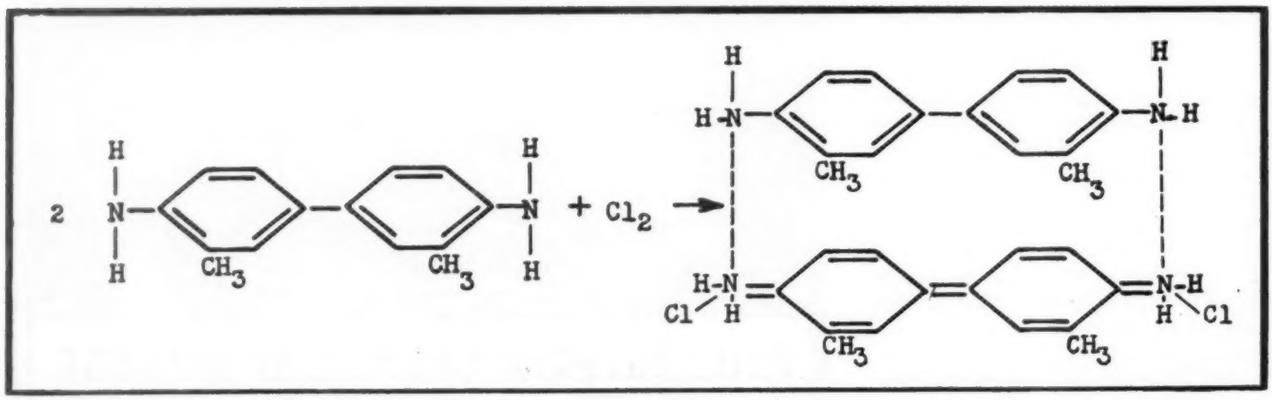
Three important reactions, with their reacting environment discussed, follow:

1. *Chlorine reacts with ortho-tolidin to form meriquinones* in accord with the accompanying Reaction "A."

The meriquinone[5] is formulated as one mol of O-T and one mol of the quinoid form of O-T, or one mol of the unoxidized O-T and one mol of O-T oxidized fully to the quinoid form. The meriquinone of O-T is, therefore, O-T partially oxidized to the quinoid form. Hence, the use of the prefix "meri," from the Greek "Meros," meaning "partly."[7]

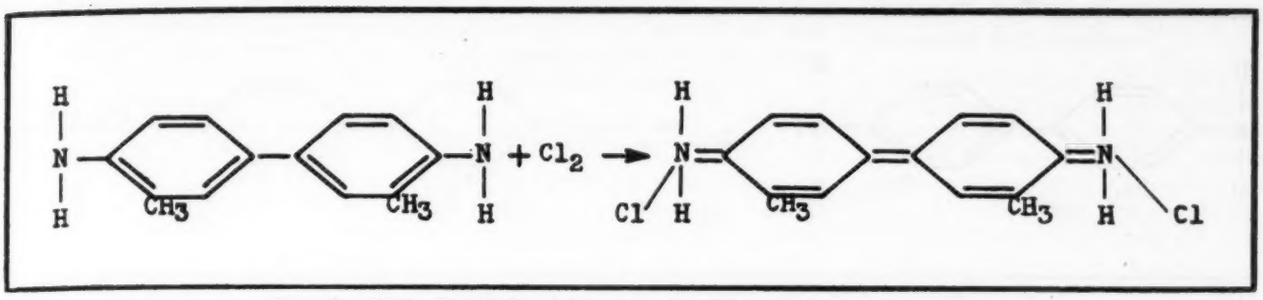
Meriquinones, blue to yellow in color and any color that can be imagined by mixing the two colors in varying proportions, are formed only when the pH of the medium in which the O-T and chlorine reacts is above 1.8. From a pH of 2.0 to over 6.0 O-T in the presence of free chlorine might appear to be a fairly good pH indicator. Colors for specific pH values have been observed and reported in the literature. Actually, the color of the meriquinone changes both with pH and with the amount of O-T present, as noted below. At pH values around 7.0 a yellow color can be obtained. All of the colors produced at pH values above 1.8 are subject to rapid fading, such instability appearing to increase with increasing pH.

Reaction "A" indicates that two mols, or six gravimetric units, of O-T react with one mol, or one



Reaction "A"—The Meriquinone Reaction Between Chlorine and O-T.

o-tolidin	*Chlorine*	*meriquinone of o-tolidin*
(2 *mols.*)	(1 *mol*)	(1 *mol*)
(6 *gravimetric units*)	(1 *grav. unit*)	7 *gravimetric units*)



Reaction "B"—The Holoquinone Reaction Between Chlorine and O-T.

o-tolidin (1 *mol*) (3 *gravimetric units*) | *Chlorine* (1 *mol*) (1 *grav. unit*) | *holoquinone of o-tolidin* (1 *mol.*) (4 *gravimetric units*)

gravimetric unit, of chlorine to form meriquinones. Under holoquinones, referred to later, it is to be noted in Reaction "B" that one mol, three gravimetric units, of O-T reacts with one mol, or one gravimetric unit, of chlorine to form the fully oxidized quinoid form of O-T. Therefore, the meriquinone formula in Reaction "A" represents O-T oxidized 50 per cent of the way to the quinoid form.

When the gravimetric ratio of O-T to chlorine varies from infinity down to 6:1, the meriquinone colors vary from a blue, where the O-T is only slightly oxidized, to a green, where the O-T is more fully oxidized. The colors appear to be mixtures of blue meriquinones and yellow holoquinones. When the gravimetric ratio of O-T to chlorine proceeds downward from 6:1 to 3:1, the colors vary from that of the green meriquinone to that of the yellow holoquinone. At this point the O-T is fully oxidized to the quinoid form. Since oxidation is also dependent upon the pH in the range of 1.8 or greater, the color likewise will vary for any given O-T to chlorine ratio, depending upon the pH. As a result, any correlation of colors with various O-T to chlorine ratios or pH would be open to error.

If an insufficient amount of O-T is present to form any of the above mentioned meriquinone colors (namely, less than the 3:1 O-T to chlorine gravimetric ratio), a red color is produced with high chlorine residuals, which is more indicative of the amount of O-T present than chlorine.

Although the color produced would indicate whether a sufficiency of O-T is present for meriquinone formation, the changes in the meriquinone color for any given chlorine residual, due to changes in pH and the amount of O-T present, would be so great as to render the method impractical.

The formation of meriquinones cannot be considered for use in the quantitative determination of high chlorine residuals for the following reasons:

a—The instability of the color produced.

b—The formation of varying colors with varying pH which would be almost impossible to control.

c—The formation of varying colors with varying quantitative relations between the reacting reagent O-T and the chlorine, conditions almost impossible to control.

2. *Chlorine reacts with O-T to form holoquinones,* in accord with the accompanying Reaction "B."

The holoquinone is formulated as one mol of the quinoid form of O-T, or one mol of O-T fully oxidized to the quinoid form. Hence, the use of the prefix "holo," from the Greek "holos," meaning wholly.

The holoquinones are yellow with low chlorine residuals, but become a deeper yellow and finally a red-brown with ascending chlorine residuals. They are formed when the pH of the reacting mixture of the O-T and chlorine is 1.8 or less. The color is almost identical and relatively stable for like chlorine residuals at any pH below 1.8. The holoquinone colors at these latter pH's are those with which everyone is familiar. They form completely within four minutes at a pH of 1.8 or slightly less. At lower pH values they easily form within two minutes; in fact, maximum color development takes place almost instantaneously. The holoquinone color produced with free chlorine should be read within a short time after the O-T and chlorine are mixed, since a slight fading is noticeable after a lapse of five or more minutes.

The above reaction indicates that one mol, or three gravimetric units, of O-T reacts with one mol, or one gravimetric unit, of chlorine to form holoquinones. For all of the chlorine to react with the O-T and produce a color equivalent to the amount of chlorine present, at least three times as much O-T as chlorine by weight must be present.

Investigation has shown that the excessive amount of O-T provided by using any O-T solution of ordinary strength will not affect the yellow or brown holoquinone color produced by high chlorine residuals at a pH of 1.8 or less. When the O-T is quantitatively deficient, or less than the three to one gravimetric ratio for O-T and chlorine mentioned above, the full yellow holoquinone color is not produced even when the pH is 1.8 or less. Investigation has shown that the amount of O-T must never be less than the 1:1 mol ratio or 3:1 gravimetric ratio with chlorine if the holoquinone is to be formed and the test used as a quantitative measurement of chlorine residuals. When the O-T becomes slightly deficient, an orange color is produced, and when the O-T becomes very decidedly deficient the color becomes red and leaves some free chlorine in the water.

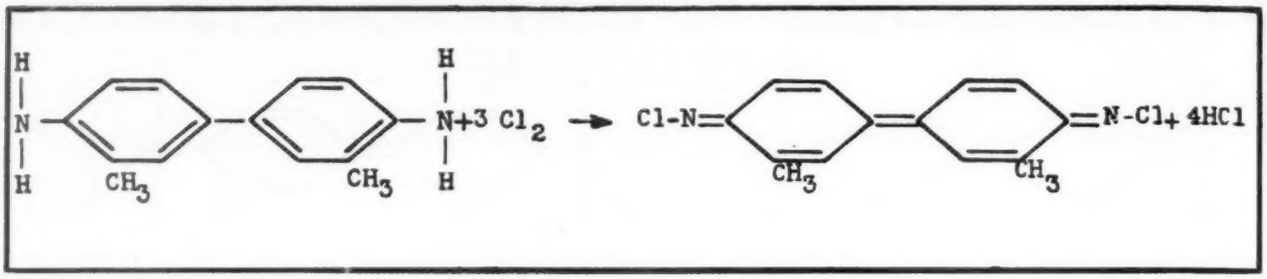
The formation of holoquinones at pH values of 1.8 or less can be considered for use in the quantitative determination of high chlorine residuals for the following reasons:

a—The stability of the color produced.

b—The ability to obtain almost the same color with the residuals at any pH of 1.8 or less.

c—The ability to obtain this yellow to brown color not only when the reacting reagent, O-T, is in excess of the required amount, but also a fluctuating excess within reason, thereby insuring a quantitative colorimetric determination of the chlorine.

In these three respects the holoquinones formed at a pH of 1.8 or less vary from the meriquinones which are only formed at pH in excess of 1.8. When the holoquinone test is not a quantitative colorimetric determination for chlorine residuals at a pH of 1.8 or less, the analyst is immediately warned of the deficiency of the reacting reagent (O-T) by the formation of an orange or red



Reaction "C"—The Chlorine Substituted Holoquinone Reaction.

o-tolidin (⅓ *mol*) (1 *gravimetric unit*) — *Chlorine* (1 *mol.*) (1 *grav. unit*) — *chlorine-substituted holoquinone* (⅓ *mol*) (*approx.* 1⅓ *grav. units*)

color rather than the desired yellow to brown holoquinone.

3. *Chlorine reacts with O-T to form the chlorine substituted derivative of the holoquinone,* in accord with the accompanying Reaction "C."

The chlorine substituted holoquinone[4] is formulated as one mol of the holoquinone, in which one hydrochloric acid has been split off of each nitrogen group at either end of the quinoid structure, and the remaining hydrogen replaced by chlorine. This compound constitutes the highest possible oxidation product of the holoquinone that can be obtained other than any that might be formed through the oxidation of the quinoid groups themselves.

The chlorine substituted holoquinones are red, the color often being referred to as a "cherry" red. This compound is apparently specific for chlorine, since it is definitely a chlorine substituted derivative. In this respect they differ from the meriquinones and holoquinones, for these latter can and often are easily produced by oxidizing agents other than chlorine. The chlorine substituted holoquinones are best formed when the pH of the reacting mixture of O-T and chlorine is 1.8 or less, but can do so to some extent as pointed out under meriquinones. If a sufficient quantity of hydrochloric acid is not present, a red precipitate is apt to form instead of a red solution. This condition occurs when the chlorine residuals are high. The red colored solution is quite stable if it can be kept from precipitating out.

Reaction "C" indicates that one-third mol, or one gravimetric unit, of O-T reacts with one mol, or one gravimetric unit, of chlorine to form the red chlorine substituted holoquinone. There is one exception to this that has resulted in many analysts assuming the red colored solution to be indicative of high chlorine residuals. At a chlorine residual of 1.0 p.p.m. the yellow holoquinone is formed instead of the red compound, even if the above ratio of O-T to chlorine is maintained. At a chlorine residual of 2.0 p.p.m. some of the red chlorine-substituted derivative is obtained if the 1:1 ratio is adhered to. At chlorine residuals of 3.0 p.p.m. to 5 p.p.m., the red derivative only is obtained if the ratio is adhered to, but if the usual quantity of O-T is added, only a small amount of the red derivative is formed, part of the color being the yellow holoquinone. For chlorine residuals of 10 p.p.m. the red substituted derivative is obtained whether an attempt is made to obtain the O-T to chlorine gravimetric ratio of 1:1, or whether the test is conducted by the usual procedure of adding 1 ml. O-T solution to 100 ml. of a 10 p.p.m. chlorine water. In this latter case the O-T to chlorine gravimetric ratio is also 1:1.

It is to be noted that the quantity of O-T required to form the red chlorine-substituted derivative with high chlorine residuals is only one-third of the amount required to form the yellow holoquinone; i.e., when the red chlorine-substituted derivative is formed the amount of O-T present is decidedly deficient in the amount required for yellow holoquinones formation. For all of the chlorine to react with O-T to form a red color equivalent to the amount of chlorine present, equal amounts of O-T and chlorine by weight must be present. Investigation has shown that when equal amounts of each are present, the method *is* a quantitative colorimetric method for high chlorine residuals.

The futility of the use of the red chlorine-substituted derivative as a quantitative colorimetric method for determining high chlorine residuals requires some explanation. For this red color to be a quantitative index it is essential that the analyst know exactly how much chlorine is present before the test is made. As a result of this the test becomes valueless for determinations of unknown high chlorine residuals. When the amount of O-T in relation to chlorine slightly exceeds the 1:1 gravimetric ratio, some of the red derivative is still formed, but as the amount of O-T becomes more and more excessive, the solution rapidly changes from a red to an orange, and finally to the yellow or brown holoquinone solution when the O-T, in relation to chlorine, reaches the 3:1 gravimetric ratio.

When the O-T is deficient, or in relation to chlorine is less than the 1:1 gravimetric ratio, the red compound is formed, leaving some chlorine in solution. The method then becomes a quantitative colorimetric test for O-T rather than chlorine.

The formation of the red chlorine-substituted derivative can be considered as a quantitative colorimetric method for determining O-T, but most certainly not chlorine. In spite of the stability of the red color and the maintenance of such a color in solution by maintaining enough acidity to keep it from precipitating, it cannot be used as a quantitative determination of high chlorine residuals because of the exacting ratios of O-T to chlorine required. To accomplish this the analyst would have to know the chlorine residual before it was determined.

From the above discussion of the various reactions between O-T and chlorine it is evident that the only reactions which can be used for the quantitative colorimetric estimation of high chlorine residuals is the one in which the yellow to brown holoquinone is formed. Two prerequisites are required to obtain this reaction:

a—The pH of the final mixture of O-T and chlorine water must be 1.8 or less.

b—An excess of the reacting reagent (O-T), as in all quantitative determinations, must be present at all times.

The final pH of the O-T to chlorine mixture must be 1.8 or under. The acid required to lower the final pH to these values is supplied in the O-T solution. The present O-T solution in *Standard Methods* contains

10 per cent concentrated hydrochloric acid by volume. It is essential[2] that a 20 per cent concentration hydrochloric acid by volume be used. One ml. of this reagent added to 100 ml. chlorinated water has been found sufficient to keep the pH below 1.8 for all alkaline waters normally encountered. On going to the other extreme and adding equal volumes of this O-T solution to equal volumes of chlorine water, the final acid concentration is 10 per cent by volume. Investigation has shown that this acid concentration is entirely too high for the yellow holoquinone color produced for it has a tendency to shift the color slightly in the spectrum, although probably not visually noticeable. A final acid concentration of 5 per cent by volume has been found to be a more reasonable figure. Therefore, if equal volumes of O-T solution and chlorine water are used, the O-T solution should contain not more than 10 per cent hydrochloric acid by volume.

An excess of the reacting reagent (O-T) must be present at all times; i.e., at least three times as much O-T must be gravimetrically present as chlorine. Under the present *Standard Methods*, for determining chlorine residuals, of 1.0 p.p.m. or less, 1 ml. of O-T solution is added to 100 ml. chlorine water. The highest chlorine residual that can be involved under this procedure and still maintain the requisite minimum gravimetric O-T to chlorine ratio of 3:1 is 3.33 p.p.m. Under the present *Standard Methods* for chlorine residuals of 1.0 to 10.0 p.p.m., 5 ml. O-T solution are added to 100 ml. chlorine water. The highest chlorine residual that can be involved under this procedure and still maintain the requisite minimum gravimetric O-T to chlorine ratio of 3:1 is 16.66 p.p.m. For higher chlorine residuals it is evident that a different procedure must be followed.

A Modified Procedure Necessary

A gravimetric ratio of O-T to chlorine of at least 3:1 can be maintained by adding less than the equal amount of the chlorinated water to the usual quantity of O-T solution, or by adding more than the usual amount of O-T solution to the usual amount of chlorinated water. The first has been developed by Mr. A. E. Griffin of the Wallace and Tiernan Co., and is known as the "Drop Dilution Method." The second has been investigated by the writer. Each will be described briefly.

The Drop Dilution Method

In the "Drop Dilution Method" a small portion of the high chlorine residual water is added to a known volume of distilled water containing the usual quantity of O-T. The color developed is compared with any of the present permanent chlorine standards which go up to 1.0 p.p.m. A dropper delivering 18 to 20 drops per ml. is used for the chlorine water. A number of drops of the chlorine water are added to the glass cell or Nessler tube containing distilled water and the usual quantity of O-T solution (Volume A). A quantity of chlorine water (Volume B) sufficient to give a good reading with the permanent chlorine standards should be used. The reading should be made two or three minutes after the addition of the chlorine water. The value of the high chlorine residual can be calculated as follows, omitting the volume of the chlorine water in the numerator of the equation if it is of insignificant magnitude:

$$(Volume\ A + B)\ x\ P.P.M.\ Cl\ matched = \text{Value of Unknown in P.P.M. Cl}$$

Volume B.

The Equal Volume Method

In the second method a considerable quantity of O-T is added to the usual volume of chlorine water. Due to the difficulty of dissolving more O-T than the amount already available in the present solution, as prescribed in *Standard Methods*, it becomes necessary to add larger volumes of the present strength O-T solution rather than smaller volumes of a stronger O-T solution to supply a sufficient quantity of the O-T. Investigation shows that this can be accomplished by employing the present strength O-T solution and combining equal volumes of the O-T solution and chlorine water. Since equal volumes are used, the acid strength of the O-T solution, as heretofore mentioned, should be reduced to ten per cent by volume. Investigation shows that chlorine residuals up to 250 p.p.m. can be accurately measured by this method with little trouble, providing the chlorine water is added to the O-T, rather than the reverse.

Improved Method of Preparing O-T Solution

Before concluding, it is worthy to report that during the development of these methods of quantitative analyses an easier and more direct method of preparing O-T solutions is being used. Since O-T ([6]) is insoluble in water, a hydrochloric acid paste is usually made as prescribed in *Standard Methods*. Now, since O-T dihydrochloride ([3]), is extremely soluble in water and is usually purer than the O-T this compound is simpler to use. Since 1.50 grams of O-T dihydrochloride are equivalent to 1.00 grams of O-T, the solution is prepared simply by dissolving 1.50 grams of the dihydrochloride in 800 ml. or 900 ml. of distilled water and making up to 1 liter with 200 ml. or 100 ml. of concentrated hydrochloric acid, depending on whether the 20 or 10 per cent hydrochloric acid O-T solutions by volume are to be used.

This discussion brings to the attention of the water works profession the essential reactions between O-T and chlorine. It shows that the yellow holoquinone color is in every respect reliable, and can be used for the estimation of high chlorine residuals if correctly developed. It also shows that the red chlorine-substituted holoquinone, while specific for chlorine, cannot be used as a reliable method of determination of high chlorine residuals. Actually, it has value only as a method for determining O-T. Making use of the satisfactory yellow holoquinone, two quantitative colorimetric methods for determining high chlorine residuals are presented. In making O-T solutions the use of O-T dihydrochloride, rather than O-T is recommended as a simpler procedure.

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3. Schiff, Ostrogovich, Ann. 278, p. 376, p. 378 (1894).

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The Editor's Comments

An Explanation

ON SEVERAL occasions we have been asked if the paper situation was giving us much difficulty, or anticipated difficulty, in the matter of securing sufficient quantity or the desirable quality of paper for our needs in the production of *"Water Works and Sewerage"* and other Gillette publications.

Our answer, to date, has been that we have felt very fortunate in being able to secure ample paper stock of approximately the same quality and weight as in the past, other than the whiteness (degree of bleaching) of the pulp, which has been reduced throughout the pulp and paper industry to release more chlorine for war and public health uses.

In producing this issue, however, we have had our first experience of not being able to go to press with the customary quality of paper. The reader will note this without having to be told. The paper used is of noticeably lighter weight and therefore thinner than that heretofore used. This gives the impression of far fewer pages in the issue and the sheets seem less bright because of the thinness, and also the coming through of some ink shadow from one to the other side of the printed page. It will also be observed that the noticeably heavier cover weight stock had to be used for the color forms in the advertising section.

While the grade of paper which we have been using is still available, and has been on order for some time, the matter of getting it from the mills to the printer is the present difficulty. We do not wish to say that this will be the only issue of 1942 to be produced from sub-normal paper stock, but we are assured by our paper suppliers that the customary grade should certainly be delivered before our December issue goes to press. The whole matter, in a word, is a problem of shortage in transportation facilities rather than in production and supply.

This hopeful waiting for delivery of our customary grade of paper has amongst other things been responsible for the appearance of this issue later than otherwise, which is regrettable. Our hope, now, is that travel through the mails, which are heavier than usual at this seasonally heavy period, will not add further to the lateness of receipt of this issue by readers.

And this last remark leads us to say that there has been a general complaint of delayed travel of magazines from publisher to subscriber. While we are not amongst those who might consider this of major consequence, when there are so many things of more serious nature to worry over in these days, we mention this situation as one created by the times and as an explanation of what has been the cause for some issues reaching subscribers later than would have otherwise been the case. Let us hope that there will be a minimum of delay in transit and delivery of this already late issue, which the Chicago Post Office assures us will at least clear that station promptly.

What is concerning us more now than anything else is what is ahead for us in 1943 in respect to the manpower situation confronting our engraving and printing establishments. Already operating short handed, matters are worsening in these quarters and we see the probability that with loss of shop personnel, slower production is to become a problem of increasing concern, although women are being trained as replacements to the fullest permissible extent.

A Study in Public Relations

September 5, 1942.

Safford Municipal Utilities,
Safford, Ariz.
Gentlemen:

Referred from our water bill we paid since we opened for business, and we could find any one of them has such a big amount of cost like we had in July and August. We are wondering why the business is difference but the water bill?

In fact, we thinks it must be some uncertain condition with our water-meter, but we can't tell its sure, because we don't know anything about it. But we will apprecate, if you kind enough to send a man come here to check it for us as quickly as possible.

Thank you.

Yours Truly,

* * *

G. A. Rhoads, manager of Municipal Utilities at Safford, Ariz., writes in connection with the above "customer's inquiry," as follows:

"I am sending you a verbatim copy of a letter we received the other day from a Chinese who operates one of our better class cafes. It struck my funny-bone and I thought, perhaps, it might make the same impression on you. Though his rhetoric may be faulty, he did express himself so that the reader could have no doubt as to what he wanted done and why. And that, I think, is really the sole use we have for words. We checked his service, found the cause of his trouble, and left a satisfied customer. And that, my dear sir, is very nearly the sole reason for a water works man."

O.K., Mr. Rhoads, and this, my dear sir, is what we would term a study in Public Relations.

L. H. Enslow

MEETINGS SCHEDULED:

Nov. 30-Dec. 4—NEW YORK, N. Y. (Hotel Astor).
American Society of Mechanical Engineers. (Annual Meeting.) Sec'y, C. E. Davies, 29 W. 39th St., New York, N. Y.

Dec. 3—HEMPSTEAD, L. I., N. Y. (Elks Club).
Long Island Section, New York State Sewage Works Ass'n. (Dinner Meeting, 6:30 P. M.) Acting Sec'y-Treas., C. George Andersen, 66 Sherman Ave., Rockville Centre, N. Y.

Dec. 5—TONAWANDA, N. Y. (Delaware Hotel).
Western Section, N.Y.S.S.W.A., (Annual Meeting), Sec'y, Dr. George E. Symons, Sewage Treatment Works, Buffalo, N. Y.

Dec. 9—BANGOR, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Winthrop, Me.

Dec. 30—NEW YORK, N. Y. (Commodore Hotel).
New York Section, A.W.W.A. Mid-Winter War Conference. Sec'y-Treas., R. K. Blanchard, Neptune Meter Co., 50 W. 50th St., New York, N. Y.

Jan. 20-21—NEW YORK, N. Y. (Eng. Societies Bldg.)
American Society of Civil Engineer's. (Annual Meeting.) Exec. Sec'y, Geo. T. Seabury, Eng. Societies Bldg., 33 W. 39th St., New York, N. Y.
(Sanitary Engineering Div. Sessions, Thursday, Jan. 21.)

Jan. 22-23—NEW YORK, N. Y.
New York State Sewage Works Ass'n. (Hotel McAlpin.) Sec'y-Treas., A. S. Bedell, State Dept. of Health, Albany, N. Y.
(Joint Annual Dinner of N.Y.S.S.W.A., and the Sanitary Eng. Div. of A.S.C.E., Jan. 22. Joint inspection trip Saturday, Jan. 23.)

Apr. 9, 1943—HAMILTON, ONTARIO (Royal Connaught Hotel).
Canadian Section A.W.W.A. Sec'y, A. E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ont.

Sewage-Treatment Works

Administration and Operation

By C. E. KEEFER
Bureau of Sewers, Baltimore, Maryland

673 pages, 6 x 9, 177 tables, 167 diagrams, charts, graphs, and illustrations, $6.00

This practical manual comprehensively presents the problems of administration, operation, maintenance and design of sewage-treatment plants, and how to handle them.

Drawing upon actual operating results and experience obtained at a large number of outstanding sewage works, this book covers sewage treatment in a thorough and practical manner—from characteristics and composition of sewage, through the various stages of treatment, to its eventual disposal.

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Water Works & Sewerage
330 South Wells St., CHICAGO
155 East 44th Street, NEW YORK

288-D

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Flexible Power Drive will save many precious man-hours without slowing down your sewer cleaning program. Public health and morale demand there be no blackout of sewer cleaning operations.
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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Water Works & Sewerage, published Monthly at Chicago, Ill., for Oct. 1, 1942.

State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edward S. Gillette, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Water Works & Sewerage and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Gillette Publishing Co., 330 S. Wells St., Chicago, Ill.

Editor—L. H. Enslow, 155 E. 44th St., New York, N. Y.

Managing Editor—John Cecil Black, 330 S. Wells St., Chicago, Ill.

Business Manager—Edward S. Gillette, 330 S. Wells St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Gillette Publishing Co., 330 S. Wells St., Chicago, Ill.
L. H. Enslow, 155 E. 44th St., New York, N. Y.
H. P. Gillette, 330 S. Wells St., Chicago, Ill.
Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.
Mrs. R. W. Hume, 303 S. Stone Ave., La Grange, Ill.
Louis E. Forsythe, 13 E. Windemere Terrace, Lansdowne, Pa.
Provident Trust Company, 17th and Chestnut Sts., Philadelphia, Pa.
Edward S. Gillette, 330 S. Wells St., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is —. (This information is required from daily publications only.)

EDWARD S. GILLETTE,
Business Manager.

Sworn to and subscribed before me this 30th day of September, 1942.

(Seal)

KITTIE C. WOULFE,
Notary Public.
(My commission expires Feb. 7th, 1946.)

LITERATURE AND CATALOGS

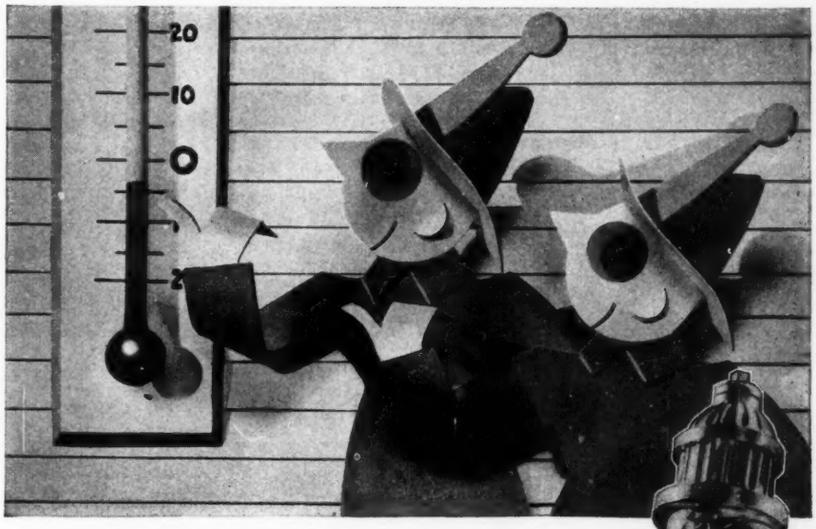
"The Economics of Cement Dispersion" is the title of a 40 page Research Paper written by Dr. Edw. W. Scripture, Jr., Director of the Master Builders Research Laboratories, Cleveland, Ohio. The paper offers a comparative study of the cost of providing cement dispersion with a full discussion of the several advantages which dispersion of cement through an added agent to the mortar offers. Chief amongst such advantages are: (1) Increased life of structure and lower costs of maintenance; (2) permitting design of concrete mix to provide minimum costs for a given quality or maximum quality at a given cost; (3) reduced material costs and lower labor costs for placing, patching, rubbing and finishing.

The paper reveals the comparative effects of adding a dispersion agent as against the use of a full extra bag of cement in the mortar batch. It is demonstrated that dispersion will produce strength equal to or greater than the added bag of cement; will produce greater workability with respect to mobility and cohesiveness; higher resistance to freezing and thawing and to attack by sulphate water or septic sewage; lower absorption and permeability; less volume change and lower temperature rise than the richer mixture involving the added bag of cement per batch.

Dr. Scripture's analysis closes with the conclusion that in producing concrete structures the matter of useful life and maintenance should rule in comparing ultimate economy as against original costs, and that the use of cement dispersing agents can be thoroughly justified whether the aim is to secure concrete of a given quality at minimum cost or concrete of maximum quality at a given cost. This discussion makes a good case for the practice of cement dispersion in attaining high design flexibility and fitting the conditions to meet the individual circumstances. For a copy of this illuminating and interestingly presented argument for cement dispersion ask for Research Paper No. 36. Address Master Builders Research Laboratories, 7016 Euclid Ave., Cleveland, Ohio.

"Defender" Fire Hydrants are the subject of an illustrated folder recently issued by the Rensselaer Valve Co. These improved hydrants are easy to service as all working parts can be reached through the top. Built with a ground fire-flange, the hydrants are readily lengthened without digging and without water shut-off. Water hammer is eliminated through the so-called "knuckle joint" principle, the main valve moving slowly to seat (approximately ⅛ inch on last turn) against water pressure. Other distinctive features are shown in a series of cross-sectional photographs and a dimensional diagram. Copies can be obtained from Rensselaer Valve Co., Troy, N. Y.

Pacific Flush-Tank Installations during recent years are tabulated in an interesting handbook recently published by this 50-year-old manufacturer of sewage treatment equipment. After a short statement about the 221 war projects that are using P. F. T. equipment, the handbook tells its story en-



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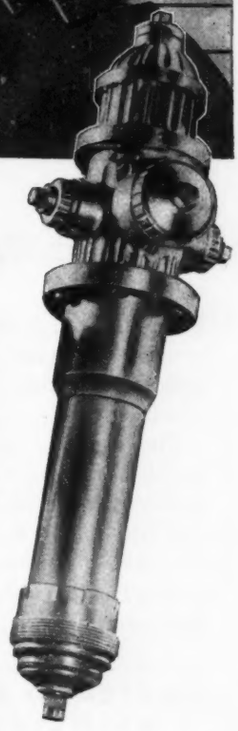
Guard against a poor fire record this winter. Make-shift heating will mean trouble with every cold snap. That's bad, but fires combined with frozen hydrants would be even worse. That's why Mathews-protected communities are lucky. A properly set Mathews Hydrant can't freeze. The heave of frozen ground cannot strain or break it. Its drainage is complete and automatic. Its threads are sealed in a dry operating chamber. And, being as replaceable as a spare tire, it need never be dug up through frozen ground in case of traffic accident. "Frost-proof" is the word for Mathews.



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tirely by a series of well organized tables. Pages devoted to installations of floating covers give such information as the plant locations, designing engineers, tank shapes and sizes, types of treatment, capacities, and general design data. Other sections give similar information on gas utilization equipment and rotary filter distributor installations. A copy of this informative handbook can be obtained by writing Pacific Flush-Tank Co., 4241 Ravenswood Avenue, Chicago, Ill.

Some Good Used Water Works Equipment is described and illustrated in a pair of leaflets recently issued by the Republic Textile Equipment Co. The larger leaflet lists a variety of portable equipment, including water pumps, blowers, crushers, grinders, presses and air compressors. Several Permutit water softeners are offered. A quantity of flanged cast iron pipe, from 8 in. to 18 in. in diameter, several large sizes of cast iron valves, a Baker electric lift truck and a number of closed and open steel tanks are other interesting items. For further information write Republic Textile Equipment Co., Inc., 40 Worth St., New York, N. Y.

Wrought Iron Pipe Threading is the subject of a 20-page illustrated brochure recently published by Byers of Pittsburgh. The brochure explains the theory of threading and discusses the type of threading equipment in general use. Considerable space is devoted to a section dealing with the causes and correction of threading troubles. Diagrams and photographs show the common sources of trouble and the most expedient and economical means of correcting them. A list of "do's" and "don'ts" on the last page begins with the obvious though often overlooked warning—"Don't try to work with dull tools." A copy of this informative and timely brochure aimed at conservation will be sent on request made to A. M. Byers Co., Pittsburgh, Pa.

Inertol Protective Coatings have been assisting water works engineers in guarding against corrosion and deterioration of steel and concrete for forty years. In a new leaflet the Inertol Co. gives its latest recommendations for various types of surfaces. Each patented product has characteristics designed to solve specific coating problems. The list of uses covers all types of steel tanks and basins, dams and reservoirs, interior floors, concrete and brick buildings, pumps, piping, and aerator equipment. Recommendations for any given job are accompanied with facts about the cost, the method of application and the approximate longevity of the coating. The folder also contains endorsements of water works superintendents throughout the country, describing their experiences with protective paints and enamels. To obtain a copy of leaflet No. 590 write Inertol Company, Inc., 470 Frelinghuysen Avenue, Newark, N. J.

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Durability records like these account for the vast scale on which concrete sewer pipe is in use throughout the world. And it is the best possible evidence that concrete pipe sewers, properly designed and constructed under the supervision of competent sanitary engineers, will serve your community for many decades with utmost economy.

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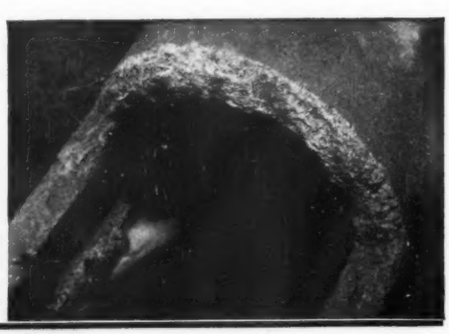
Chicago, Ill.

Buy More War Savings Bonds



MINNEAPOLIS, MINN.— 12-in. concrete pipe sanitary sewer installed in 1886. Found to be in excellent condition in 1933, after 47 years. Minneapolis has more than 35 miles of this old concrete pipe in its sewerage system today.

BUY WAR BONDS

AND SAVINGS STAMPS

EQUIPMENT NEWS

"True-Cure" for Speeding Concrete Cure

(A New Trucson Product)

• "True-Cure," a new concrete curing compound produced by the Trucson Laboratories of Detroit, is a clear liquid which is sprayed on concrete immediately after finishing. It gives the equivalent of a 14-day water cure without the labor and expense of hauling dirt and keeping the concrete surface wet.

Laboratory tests show that "True-Cure" has moisture retaining qualities better than 96 per cent at 24 hours at a temperature of 110 deg. F., or 90 per cent at 7 days. The liquid compound can be applied as soon as the finishers are off the work; curing begins quickly, thereby avoiding crazing and shrinkage cracking associated with too rapid moisture evaporation.

For additional information ask for Bulletin No. 534. Address: The Truscon Laboratories, Detroit, Mich.

New Filtration Crucible Requires No Asbestos Mat

• A new filter-crucible which requires no precious long fiber asbestos has been developed by the Selas Co. and is now being marketed by the Chemical Rubber Co. of Cleveland. The base of the Selas all-porcelain filter-crucible is a permanent calibrated micro-porous disc requiring no pads, papers, treatments or other preparation for either filtering or the ashing operations. Crucibles may be used repeatedly. Some have been used on over 100 successive ashing determinations without any loss of weight or change of disc porosity.

Selas porcelain crucibles, now being used by a number of leading laboratories, have been reported entirely satisfactory where asbestos-mat Gooch crucibles were formerly used. They not only shorten testing time, but simplify laboratory routine. For further information write to the Chemical Rubber Co., 2310 Superior Avenue, Cleveland, Ohio.

Plastic Replaces Metal in Improved Dust Respirator

• In keeping with the order of the day the M.S.A. Comfo Dust Respirator has been re-designed with filter cases of black plastic. In addition to release of more metal for war purposes this change in design has distinct advantages to the user.

U. S. Bureau of Mines-approved, this well-known respirator now offers better appearance plus less resistance to air flow, according to the manufacturer. The new filter container units are thinner, with rounded edges, permitting even better sidewise and downward vision.

The re-designed plastic filter cases have high impact strength with no electrical conductivity. They are not affected by perspiration, and are

★★★★★★★★ ARMY E NAVY ★★★★★★★★

Working In Emergencies

HAS ALWAYS BEEN OUR JOB

Whenever there's an emergency—a fire, watermain break, power failure, accident, flood, hurricane, or ice storm—you find Homelite Portable Pumps, Generators and Blowers on the job. And the same holds true for war.

In this war — the greatest emergency our country ever faced — Homelite has gone all out to produce units needed for the Tank Corps, Signal Corps, Air Corps and Ordnance. Not only have we improved our pumps, generators and blowers, but we have also stepped up our rate of production tremendously—without affecting the Homelite high standards of quality.

Through the combined efforts of all the men and women at Homelite — and through your cooperation, your willingness to keep your present Homelites going for the duration so that all new units can go to the government — the Homelite Corporation has just earned the highest military honor it could get, *The Army-Navy Production Award.*

★★★★★★★★ HOMELITE ★★★★★★★★

HOMELITE CORPORATION ... CHESTER, N. Y.

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

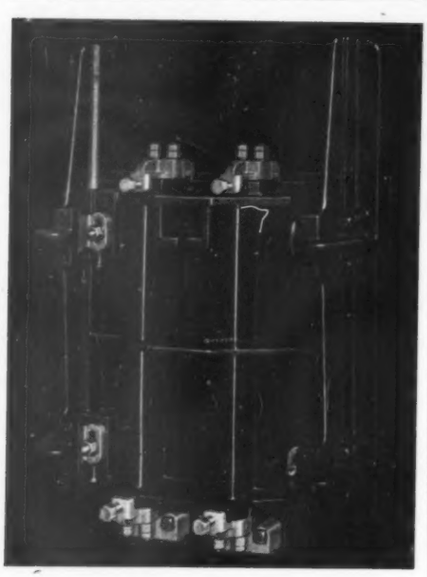
SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

75 Federal St., Boston



NATIONAL SLUICE GATES

Distinguished by precision workmanship

If you haven't seen a National Sluice Gate you can't appreciate its unusual combination of giant strength and velvet-smooth operation. Finest materials, ample sizing, painstaking workmanship and assembly assure you of a gate which really shoulders the load. Send for descriptive literature.

NATIONAL MACHINE WORKS

1559 N. Sheffield Ave., Chicago, Ill.

For WAR EMERGENCIES

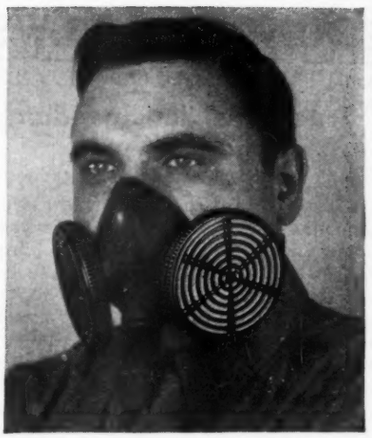
VALVES HYDRANTS

AND WATERWORKS ACCESSORIES

M & H products, including pipe line accessories, are well known for high quality of material and expert workmanship. They are made according to standard specifications and have been used for many years throughout the country. Write for Catalog No. 34.

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA



otherwise more comfortable to the wearer.

Retaining all of the earlier advantages and features, the field-proved plastic model has twin side-placed replaceable filters of unusually large area. The unit is easy to clean and maintain, and is available in types to meet various dust and mist conditions. Further details may be secured by writing Mine Safety Appliances Co., Braddock, Thomas and Meade Streets, Pittsburgh, Pa.

New Starters for Small Induction Motors

• General Electric is introducing a new line of alternating-current combination magnetic starters for induction motors up to 7½ h.p. The starters consist of a fusible motor-circuit switch and a magnetic starter incorporated in a single compact unit. They are enclosed in cabinet-type steel cases with doors that close into deep L-shaped flanges, making a tight joint between case and cover. These compact units conserve space, improve appearance, and provide greater protection for equipment and operators. The starters are completely wired and after being properly connected are ready to operate. For further information address the General Electric Company, Schenectady, N. Y.

Continuous Color and Turbidity Tell-Tale

• The new "Lumetron" colorimeter Model 400-S is a photoelectric instrument designed for continuous registration of concentration, color or turbidity of solution. Light from an incandescent lamp passes through a color filter and the liquid, and then strikes a barrier-layer photocell which transmits a current to the indicating instrument. A distinctive feature of the Lumetron is that the testing liquid passes through a glass tube rather than being contained in an absorption cell. This makes it suitable for continuous observation and control.

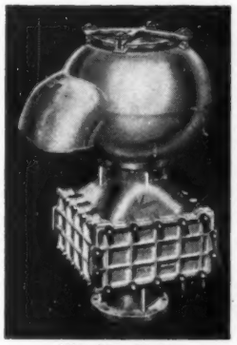
This color and/or turbidity "tell-tale"

Now! more than ever
THE PACE SETTER!
"Varec"
APPROVED
SEWAGE GAS CONTROL and Safety DEVICES PREVENT EXPLOSIONS and COSTLY DELAYS

● Combustible Sewage Gas is being controlled with safety in hundreds of "VAREC" service installations throughout the country. The "VAREC" Laboratories and Engineering Department will collaborate with you on any problem where toxic and combustible gas is present.

●

"VAREC" Approved PRESSURE RELIEF AND VACUUM BREAKER VALVE WITH FLAME ARRESTER



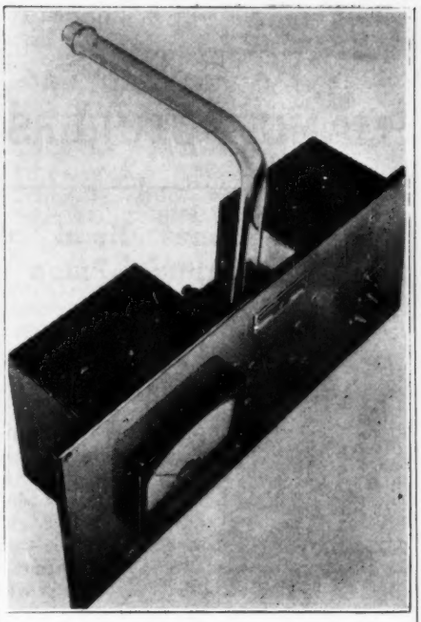
Installed on digester and gas holder domes, it affords emergency pressure and vacuum relief. Stops flame propagation. Equipped with noncorrosive telescopic flame arresting element for easy inspection and maintenance.

Fig. No. 58 C

Other "VAREC" Products

● Flame Trap Assemblies—Pressure Relief and Vacuum Breaker Valves — Flame Arresters — Flame Checks — Regulators — Check Valves—Drip Traps—Manometers—Explosion Relief Valves—Manhole Covers — Sampling Hatches.

THE VAPOR RECOVERY SYSTEMS CO.
Compton California
Branch Offices and Stocks carried at
New York City . Tulsa, Okla. . Houston, Texas
Agencies Everywhere



reminds of a similar scheme which has been in use at Denver for a number of years for the purpose of warning filter-plant operators of changes in turbidity of the raw water of Denver several miles distant when the supply enters the raw water conduit feeding the filter plant from a flashy mountain stream.

For a leaflet describing the continuous flow chlorimeter and turbidimeter in greater detail write to the Photovolt Corporation, 95 Madison Avenue, New York, N. Y.

Improved New Metal Etcher

● The Ideal Commutator Dresser Co. announces a new Electric Etcher that permanently marks anything made of steel, iron or their alloys.

To etch small tools and parts simply place them on the work plate, turn switch "on" to proper heat and start writing. A ground clamp conveniently attached to the work plate is provided for etching largely, heavy parts and castings.

"Hi-Lo" taps and a seven point switch give 14 etching heats between 115 to 1300 watts. Depth of mark can also be controlled by speed of writing.

The etching tool has special heat radiating fins and an alloy tip point. Secondary cables have asbestos covering; work plate is 4 in. by 7 in. with ground clamp attachment, 115 volt, 50-60 cycle standard—other voltages and frequencies available.

The No. 18 Machine Shop Model supplements the present line of Ideal Electric Markers and Etchers, which includes five sizes from "Thin Line" to "Heavy Duty."

Permanent identification minimizes loss and theft of costly, hard-to-get tools and instruments. Permanent marking of materials and parts avoids confusion and mistakes.

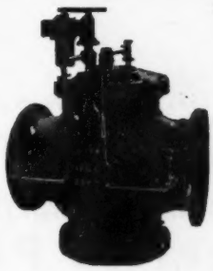
For descriptive literature write Ideal Commutator Dresser Co., 1615 Park Ave., Sycamore, Ill.

1879
ROSS
AUTOMATIC VALVES

ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES • FLOAT VALVES • REDUCING AND REGULATING VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.

COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.

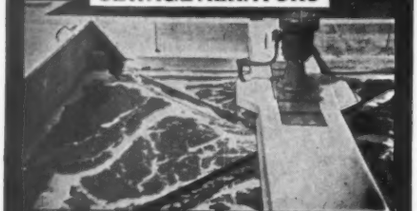


REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

AER-O-MIX
AERATOR—MIXER

Down-Draft Type
MECHANICAL
SEWAGE AERATORS



Write for information on AER-O-MIX for your SEWAGE or WATER TREATMENT APPLICATION.

VOGT MFG. CO.
INCORPORATED
P. O. Box 1122 Louisville, Ky.

WITH THE MANUFACTURERS

Binder Becomes Head of A.C.'s Centrifugal Pump Division

Walter Gust

• Walter Geist, Allis-Chalmers president, recently announced the appointment of J. Frank Roberts, head hydraulic engineer of TVA, to succeed Dr. Wm. White as the company's hydraulic department manager, and the selection of H. P. Binder as manager of the centrifugal pump department.

head, came to Allis-Chalmers in 1919, entering the company's graduate engineer training course. He became office manager in the hydraulic department and remained in that capacity until 1927. In 1938 he joined the Tennessee Valley Authority.

H. P. Binder, a veteran of 30 years with the company, had been assistant manager of the hydraulic department, in charge of centrifugal pump sales and engineering, since 1940. He entered the Allis-Chalmers graduate training program from Purdue University in 1911, and took charge of the company's first hydraulic test pit a year later. In 1917 he left the Allis-Chalmers engineering department to enter the service, serving as a captain with the first and only completely motorized field artillery unit of the regular U. S. Army in the last war. On his return in 1919 he inaugurated sales engineering work in the pump department, where Allis-Chalmers business in this type of equipment has been increased more than 100 times during that period of time.

$650.00 Prizes in War Bonds for Information on Maintenance and Salvage Methods

• In the interest of metals conservation, and to help speed war production, Metallizing Engineering Co., Inc., in a second contest is offering a total of $650.00 in War Bonds for details of maintenance and salvage procedures with the metal spraying process. First prize is $250.00, second prize $150.00, third prize $100.00, and three prizes of $50.00 each. This second contest closes December 15th. Complete information and entry forms are obtainable from "Metco News," 21-07 41st Ave., Long Island City, N. Y.

LEADITE
The Pioneer Self-Caulking Material for C. I. Pipe

Forget it with
CONFIDENCE

• Engineers and water works men have been proving it for more than 40 years . . . that *Leadite* saves in material and construction costs, *makes a good tight joint that improves with age* . . . and when the line is laid with Leadite they can forget it with confidence.

THE LEADITE COMPANY
Girard Trust Co. Bldg. Philadelphia, Pa.

No Caulking

THE LINING IS IMPERVIOUS
THE JOINTS ARE LAPPED
LIPCO PIPE
AVAILABLE *Now!*
Immediate DELIVERY
ON
STEEL, TONCAN IRON
AND WROUGHT IRON
Cement Lined
Service Pipe

CEMENT LINED PIPE CO.
Lynn, Mass.

Portable
TESTING TANKS

These tanks are of heavily galvanized steel and aluminum, sturdy and durable. Made in sizes for tests of 10 gallons and one cubic foot and guaranteed accurate within ¼ of 1%.

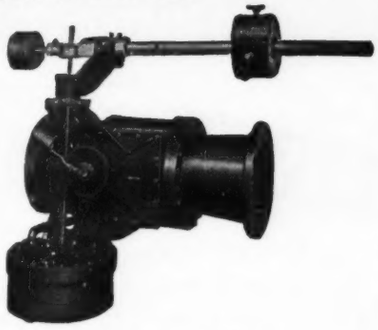
This portable testing tank is convenient for use in the meter shop or on the customer's premises. Easy to use.—calibrated in percentages fast and slow.

FORD METER BOX CO.,
WABASH, IND.

BUILDERS
WATER AND SEWAGE PLANT
Instruments

Type E Direct-Acting Controllers

Features include: precise control; compact, yet flexible design; powerful "floating piston" actuation with unique rubber piston seal; low loss of head; elbow outlet or straight through design; single blade vane-type valve; generous use of corrosion-resisting materials; and the use of the basic Venturi Tube.



Write for Bulletin 321

BUILDERS-PROVIDENCE, INC.
Division of Builders Iron Foundry
9 Codding Street **Providence, R. I.**

HYDRO-TITE

ONE POUND does the work of four pounds of lead. Much easier to use than lead and requires no caulking.

HYDRO-TITE joints are strong, very flexible and tight.

Write for our free trial offer.

HYDRAULIC DEVELOPMENT CORPORATION
MAIN SALES OFFICE - 50 CHURCH STREET, NEW YORK
GENERAL OFFICES AND WORKS - WEST MEDFORD STATION, BOSTON, MASS.
OVER 25 YEARS WITHOUT A FAILURE

"Mike" Cain Joins Penn. Salt Sales Staff

● R. L. (Mike) Cain, who for the past year served as a priority specialist for Westvaco Chlorine Products Corp., has joined the general sales department of Pennsylvania Salt Manufacturing Company, Philadelphia, in the heavy chemicals division. He was previously in charge of sales and service for Westvaco in New York City and at the same time served as divisional sales manager of the Curtin-Howe Corporation, Westvaco affiliate.

Public Works Supply Co. Made N.E. Agents for Rusta Restor Cathodic Tank Protection

● The Gregg Co. of Philadelphia, eastern representatives of Rusta Restor Corporation, announce that Public Works Supply Co. of Lynn, Mass., is now representing in the sale of RUSTA RESTOR cathodic tank protection equipment in the New England states. This arrangement follows a period in which the New England territory was handled directly by Rusta Restor Corp. from its office in Fremont, Ohio.

The Public Works Supply Co. is the selling agent of Cement Lined Pipe Co. of Lynn, known for many years as the manufacturer of cement lined service pipe. Both companies are headed by H. W. Jacobs as president, with Everett Howe, Treasurer, and Walter Arnold as manager of sales. This company is also the sales representative in New England for several other prominent firms of water works manufacturers, including Darling Valve, Ford Meter Box, and Chicago Pneumatic Tool.

All current negotiations and new business relating to RUSTA RESTOR cathodic rust prevention equipment for steel water tanks in New England will be handled by Public Works Supply Co. directly out of its office at 93 Brookline St., Lynn, Mass.

Cylinder Shortage Becomes Acute Again

● The shortage of cylinders for chlorine, ammonia, and other compressed gases is becoming more acute again, and, to prevent drastic restrictions in the distribution of these chemicals, all users and transportation companies must cooperate in returning the containers to the producers, warns R. J. Quinn of the Mathieson Alkali Works, Inc.

"Most users of compressed gases are probably trying to return their cylinders promptly, but many find that the railroads and the trucking companies are becoming increasingly unwilling to handle small shipments," states Mr. Quinn. "This situation can be remedied, however, if transportation man-

INQUIRIES INVITED
on all Problems of
WATER TREATMENT

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

ROBERTS FILTER MFG. CO.
607 COLUMBIA AVE.
DARBY, PA.

Noiseless
CHECK VALVES

. . . SMOLENSKY
Noiseless Flanged Check Valves

are used on pump discharge lines as a safety factor to protect the pumps against static load on high head to eliminate trouble, such as "water-hammer", "breakage of pumps," "pipe connections," etc.

They are also used as Foot Valves. They are quick-tight closing and are absolutely noiseless in operation.

Accepted by The Fire Underwriters.

Literature, gladly sent on request, shows dimensions and prices. Write to

●

THE SMOLENSKY VALVE CO.
1931 W. 47th St., Cleveland, Ohio

The
Meter-Master
RATE RECORDER FOR
WATER METERS
Send for Literature
F. S. BRAINARD & CO.
246 Palm Street, Hartford, Conn.

GRUENDLER'S 57th YEAR
SANITARY ENGINEERS
Send for facts on our latest
"NON-CLOG"
SEWAGE
SHREDDERS
for Municipal Plants
For the disintegration of Rag Stock, Garbage, Floatables, and Fibrous Materials *without Choke Down* so as to pass Screen Bar—
"Gruendler selected by U. S. Navy"

GRUENDLER
CRUSHER & PULVERIZER CO.
2917-29 N. Market St., St. Louis, Mo.

EDSON'S NEW
HAND PUMP

Smallest Diaphragm Pump Made, 2" Suction Open Discharge. Capacity 1400 G.P.H. Weight 50 lbs. Size No. 1.
THE
EDSON CORP'N
49 "D" Street
So. Boston, Mass.
NEW YORK: 142 Ashland Pl., Brooklyn
Catalog "T" Gives Full Data, Also Edson Hand and Power Pumps, Suction Hose and Pump Accessories

BAILEY METERS
AND CONTROLLERS
FOR SEWAGE TREATMENT
AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.
BAILEY METER COMPANY
1072 IVANHOE ROAD ● CLEVELAND O.
Bailey Meter Co. Ltd., Montreal, Canada

agers fully understand the importance of getting cylinders back for refilling as quickly as possible, and if shippers of cylinders will cooperate with the transport companies in arranging shipments that can be handled economically.

"No new cylinders can be obtained, and the number being diverted from civilian use by our war effort is constantly increasing," Mr. Quinn points out. "But if all concerned will keep the available supply in constant circulation, it should be possible to serve satisfactorily all important users of compressed gases."

"To everyone who is helping in this vital task—our thanks!" says Mr. Quinn, in speaking for the entire chlorine industry.

Novel Guide to Comparable Army and Navy Rank and Insignia

● Do you know what U. S. Army rank is equivalent to that of Captain in the U. S. Navy? What is the rank of a "four striper" in the Navy? Does a full Colonel in the Army outrank a Commander in the Navy? What is the lapel insignia of a para-trooper?

All of these and many other questions are promptly answered by an interesting little gadget being distributed by Atlas Mineral Products Co., manufacturers of pipe jointing compounds.

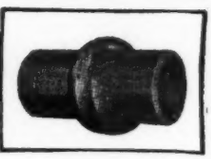
Of a size to fit the pocket, the twirl of a disc reveals in opposite boxes (windows) the rank of commissioned and line officers in the Army and Navy which are comparable or equivalent. At the same time arm and shoulder insignia show up on the uniforms of the Army and Navy figures facing each other. The margins of the Army and Navy sides of the gadget reveals the insignia of the numerous branches of the two services.

This intriguing and informative gadget can be had merely for the asking. Address The Atlas Mineral Products Co., Westown, Pa.

"Bitumastics" Subject of Prize Contest

● Wailes Dove-Hermiston is offering $250 in War Bonds and Stamps for the best photographs and descriptions of jobs involving the use of "Bitumastic" products. Awards will be made in two classifications, one covering jobs where Bitumastic materials have been in service for a number of years and the other covering recent applications. Any clear photograph or snapshot is suitable provided it is accompanied by a brief description of the details of the job. Twenty-two prizes will be given including a $50 War Bond in each class of competition. If you have a Bitumastic experience or job worthy of entry, the Wailes Dove-Hermiston Corporation, Westfield, N. J., will be pleased to hear from you. One of the 22 prizes may be yours for little effort.

ANTHRAFILT
A Filter Medium For All Purposes
ANTHRACITE EQUIPMENT CORP.
19 Rector St. New York
H. G. Turner Research Engineer
STATE COLLEGE, PA.

WESTON

GASKET AND FORM
The Perfected Method for Making
SEWER PIPE JOINTS OF CEMENT
● No jute used—gasket centers spigot.
● Definite space in each joint for cement.
● Form confines cement-grout to lower portion of joint.
● Particularly advantageous in water-bearing trenches.
● Infiltration minimized.
L. A. WESTON Adams, Mass.

ZECO
GREENSAND
ZEOLITE
ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.
ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St., New York, N. Y. Factory Medford, N. J.
Pioneer Producer of
GREENSAND ZEOLITE MINERAL

Manufacturers' Representative located in Chicago is interested in new line of mechanical equipment or automatic controls used on fluids as water, gas, steam and air for process industries as waterworks, oil refineries, chemical plants, power plants, etc. Manufacturer looking for distributor reply to **Box 2000**, Water Works & Sewerage, 330 S. Wells St., Chicago, Ill.

BUY WAR BONDS AND
SAVINGS STAMPS

Some Worthington Pump History (1840-1942)

• "Worthington News" in a recent issue contained the interesting story of how Henry Rossiter Worthington as a young engineer in 1840 designed and built the first direct-acting steam pump, which a few years later was to become a valuable asset to the U. S. Navy. This original steam pump was made by Mr. Worthington for a canal boat being constructed by him for New York State's Erie Canal. In 1847 the first of Worthington's pumps to see Naval service was installed on the U.S.S. Powhatan, and three years later additional Worthington pumps were used on her sister ship, the U.S.S. Susquehannah.

Thus began Worthington's relationship with the U. S. Navy some 95 years ago. During all the ensuing years Worthington has continued to develop pumps and other equipment for our Navy, which has just awarded to the company the meaningful Navy "E." These and other inspiring facts are told by Worthington in their special "E" Award Issue (July 1942) of the "Worthington News." Those desiring a copy with its reproductions of historical "pumping engine" cuts may have it by writing Worthing Pump and Machinery Corp., Harrison, N. J.

Where Is The Largest Rotary Distributor Installation in the U. S.?

Dayton, Ohio, with twenty 165'-diameter P.F.T. units — one of dozens of installations pictured and described in Bulletin No. 213.

The engineering data it contains shows why P.F.T. Rotary Distributors are by far the most widely used. Send for a copy.

P.F.T.

PACIFIC FLUSH-TANK COMPANY
4241 Ravenswood Ave., Chicago, Ill.
New York Charlotte, N. C.

Permanent . . . . .

REDWOOD PIPE Saves critical materials! Long known as a pipe with greater carrying capacity than metal or concrete. Does not clog, scale or pit.

LOWER labor, installation and maintenance costs. Long life, no electrolysis, contamination of water, or destruction by sulphur, salt water or other mineral impurities. New type Wyckoff California Redwood Pipe for water supply and sewage lines is a proven product.

A. Wyckoff & Son Company

ELMIRA, N. Y.
Originators of Machine Made Wood Pipe
1855 — Our 87th Anniversary — 1942

A Proven Coagulant

For water and waste treatment. Chemical costs greatly reduced by using FERRI-FLOC for sludge conditioning.

Send for literature.

Ferri-Floc
FERRIC SULPHATE

Tennessee Corporation
ATLANTA, GA. LOCKLAND, OHIO

Water Pressure Relief Valve

On excess pressure, due to line surges or excess pumping head, this valve automatically opens to dissipate necessary water volume to maintain desired line pressure. The valve is arranged either with atmospheric pilot valve exhaust or self-contained, according to service conditions and requirements.

Valves may be arranged to open at abnormal pressures and held open under subnormal pressures until the surge subsides, and then close when normal conditions prevail.

Sizes: 3" to 36"

Angle and Globe Patterns.

Write for Specifications.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

Consulting Engineers

SPECIALIZING IN THE FIELD OF

WATER WORKS & SEWERAGE

Albright & Friel, Inc.
Consulting Engineers

Water, Sewerage, Industrial Waste, Garbage, Power Plant and Valuation Problems.

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CONSULTING ENGINEERS

This Directory is used by the readers when seeking names and addresses of Consulting Engineers. Be sure your professional card is listed. Rates nominal. For particulars write—

Water Works & Sewerage
330 S. Wells St., Chicago

Morris Knowles, Inc.
Engineers

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.

1312 Park Building, Pittsburgh, Pa.

Alvord, Burdick & Howson
Engineers

John W. Alvord
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Louis R. Howson
Donald H. Maxwell

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

Civic Opera Building **Chicago**

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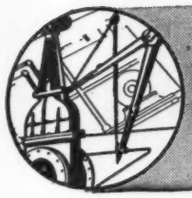

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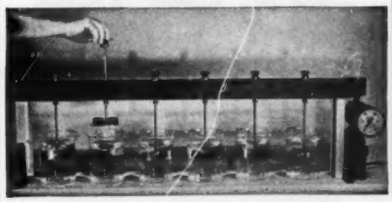

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Index TO ADVERTISERS

Albright & Friel, Inc. 84
Alvord, Burdick & Howson 84
Aluminum Company of America 8
American Brass Company, The ..... —
American Cast Iron Pipe Co. 20
American Norit Company, Inc. ..... —
American Smelting and Refining Co. ..... —
American Well Works, The ..... —
*Anderson Valve Corp. ..... —
*Anthracite Equipment Corp. 82
Armco Drainage Products Assn. ..... —
A. S. G. Pipe Lining Co. ..... —
*Atlas Mineral Products Co. of Pa., The .. 9

Badger Meter Manufacturing Co. 474-D
*Bailey Meter Co. 82
*Barrett Haentjens & Co. ..... —
Black & Veatch 84
Blake, Frank N. ..... —
Brainard & Co., F. S. 82
Buck, Seifert and Jost 84
*Builders-Providence, Inc. 81
Burns & McDonald Engr. Co. 84

*Calgon, Inc. 15
Carborundum Company, The ..... —
Carson-Cadillac Co. 85
*Carter Company, Ralph B. ..... —
Cast Iron Pipe Research Assn., The...474-B
Cement Lined Pipe Co. 80
Central Foundry Company ..... —
Centriline Corporation 73
Chain Belt Company ..... —
Champion Corporation ..... —
Chapman Valve Manufacturing Co. ..... —
Chester Engineers, The 84
*Chicago Bridge & Iron Company 7
*Chicago Pump Company 474-A
Clark Controller Co., The ..... —
*Cole Manufacturing Co., R. D. ..... —
Clow & Sons, James B. ..... —
Columbian Iron Works ..... —
Connelly Iron Sponge & Governor Co. ..... —

Darco Corporation ..... —
DeLaval Steam Turbine Co. ..... —
Diamond Alkali Company 11
Dorr Company, Inc., The .....Third Cover
*Dow Chemical Company, The ..... —
Dracco Corporation ..... —

Economy Pumps, Inc. ..... —
Edson Corporation, The 82
Electro Rust-Proofing Co. ..... —

Ferguson, S. F. ..... —
*Flexible Sewer Rod Equipment Co. 74
*Flexible Underground Pipe-Cleaning Co.. —
Ford Meter Box Co. 80
Fulton, Edward A. 84

Gardner-Denver Co. ..... —
*General Paint Corporation 18
Glace, I. M. 84
*Golden-Anderson Valve Spec. Co. 83
*Graver Tank and Mfg. Co. ..... —
Greeley & Hansen 84
Gruendler Crusher & Pulverizer Co. 82

Havens and Emerson 84
Hayden, Harding & Buchanan 84
*Hellige, Inc. ..... —
*Hill, Hubbell & Co. ..... —
Homelite Corporation, The 77
*Hydraulic Development Corp. 474-C-81

*Industrial Chemical Sales 3
*Innis, Speiden & Co. ..... —
*Infilco Incorporated 20
Iowa Valve Co. ..... —

*Jeffrey Manufacturing Company ..... —
*Johns-Manville 12-13-19

Knowles, Inc., Morris 84
*Lakeside Engineering Corporation ..... —
Lancaster Research Laboratories 84
Layne & Bowler, Inc. 86
Lead Industries Association ..... —
Leadite Company, The 80
Leitz, Inc., E. ..... —
Link-Belt Company ..... —
Lock Joint Pipe Company 17
Ludlow Valve Mfg. Co., Inc., The ..... —

*M & H Valve and Fittings Company 78
Mabbs Hydraulic Packing Co. ..... —
Macmillan Petroleum Corp. 6
Mathews Hydrants 75
Mathiesen Alkali Works, Inc., The ..... —
Metcalf & Eddy 84
Monsanto Chemical Co. 16
*Mueller Brass Co. 4
Mueller Co. ..... —
Municipal Service Co. ..... —

National Cast Iron Pipe ..... —
National Lime Association ..... —
National Machine Works 78
National Technical Laboratories 21
*National Water Main Cleaning Co. ..... —
Neptune Meter Co. 24
Newsom & Aldrich 84
Niagara Alkali Company ..... —
*Nichols Engineering & Research Corp. .. —
*Northrup & Company, Inc. ..... —
Nussbaumer & Clarke, Inc. 84

*Omega Machine Company ..... —

*Pacific Flush Tank Company 83
Peerless Pump Division ..... —
*Pennsylvania Salt Mfg. Company .....Second Cover
*Permutit Company, The ..... —
Phipps & Bird, Inc. 85
Philadelphia Quartz Co. ..... —
Phoenix Meter Corp. ..... —
Photoswitch, Inc. ..... —
Pirnie, Malcolm 84
Pitometer Company, The 85
*Pittsburgh-Des Moines Steel Co. 10
Pittsburgh Equitable Meter Co. 5
*Pomona Pump Co. ..... —
Portland Cement Association 76
*Proportioneers, Inc. 22

Ranney Water Collector Corp. ..... —
Regester, Robert T. 85
Reilly Tar & Chemical Corp. ..... —
Rensselaer Valve Co. ..... —
Riddick, Thomas M. 85
Robert and Company 85
Roberts Filter Mfg. Co. 81
Roots-Connersville Blower Corp. ..... —
*Ross Valve Mfg. Co., Inc. 79
*Royer Foundry & Machine Co. ..... —
Runyon & Carey 85
Russell & Axon 85
Ryan Company, Fred J. ..... —

Salomon & Bro., L. A. ..... —
*Schramm, Inc. ..... —
*Simplex Valve & Meter Co. 18
Sirrine & Company, J. E. 85
Smith Company, S. Morgan ..... —
Smith Mfg. Co., The A. P. ..... —
Smolensky Valve Co. 81
Solvay Sales Corporation 14
*Sparling, R. W. ..... —
Standard Dry Wall Products, Inc. ..... —
Standard Silicate Division ..... —
Stanley Engineering Company 85
*Stewart, W. H. ..... —
*Streamline Pipe & Fittings Division ..... —
*Stuart-Brumley Corp. 85

Tate Pipe Linings, Inc. ..... —
Taylor and Co., W. A. 20
*Tennessee Corporation 83
Thomson Meter Company 24
Truscon Laboratories 20

Underpinning & Foundation Co., Inc. ..... —
*U. S. Pipe & Foundry Co. ..... —

*Vapor Recovery Systems Co. 79
Virginia Smelting Co. ..... —
Vogt Brothers Manufacturing Co. ..... —
Vogt Manufacturing Co. 80

*Wallace & Tiernan Co., Inc. .....Back Cover
Warren Foundry & Pipe Corp. 78
*Westco Division ..... —
Weston, L. A. 82
Weston and Sampson 85
Whitman and Howard 85
Whitman, Requardt & Smith 85
*Wilson Chemical Feeders, Inc. ..... —
Wood Company, R. D. 75
Worthington-Gamon Meter Company .... —
Worthington Pump and Machinery Corp. —
Wyckoff & Son Company, A. 83

Zeolite Chemical Co. 82

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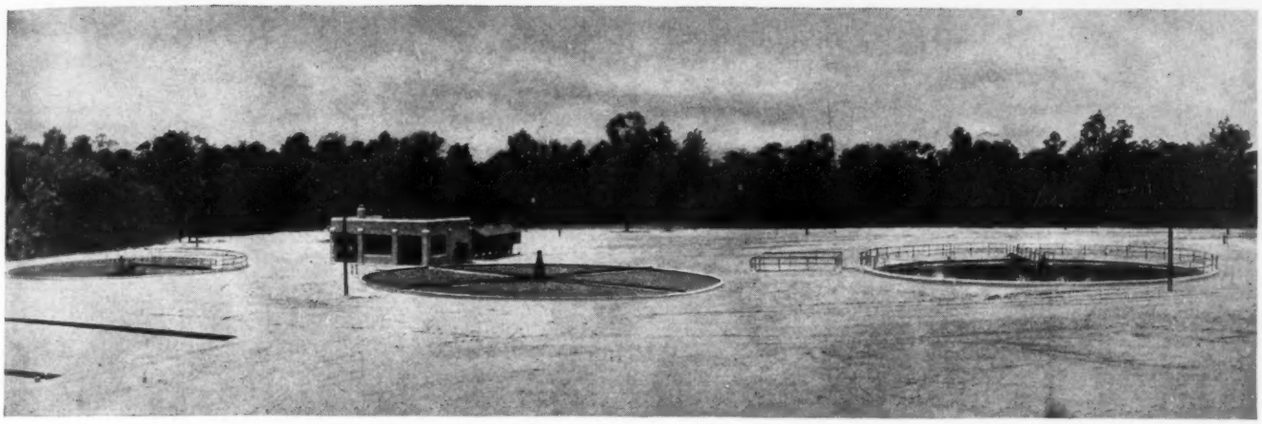

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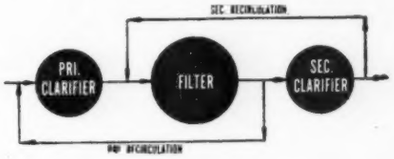

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(Operating Data from the army camp illustrated above)

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Gals./Sq. Ft./Day	
Primary Clarifier	510
Secondary Clarifier	450
Recirculations—	
Primary Ratio	1.10
Secondary Ratio	0.86
Suspended Solids—	
Raw—P. P. M.	256
Final—P. P. M.	13
Removal—Percent	94.8
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Raw—P.P.M.	310
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